Assembling the value of nature : a performative analysis of English biodiversity offsetting and the DEFRA pilot study

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Signed Declaration

I confirm that all of the work presented in this thesis is my own work

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Abstract

This thesis explores the UK Government's Department for Environment Food and Rural Affairs' (DEFRA) 2-year pilot study into biodiversity offsetting (BDO) in England. The objective is to investigate the socio-technical assemblages of biodiversity offsetting to examine what it means to value biodiversity in practice, how the ensuing values materialise and with what effects.

The thesis undertakes a multi-sited investigation of the DEFRA pilot study. Firstly I explore the origins of the BDO assemblage focussing on two of its critical elements, the policy standard of 'no net loss' of biodiversity and the central calculative device, the DEFRA metric. I contextualise these conceptual and calculative technologies within the wider socio-political milieus in which they were conceived, circulated and subsequently took effect. The next three chapters present case studies built through diachronic empirical engagements with three sites of the DEFRA pilot. These chapters trace the assemblages of actual BDO negotiations, efforts to value biodiversity by actors *in-situ,* and the tensions that threaten these processes. Lastly, I explore the value/s conflicts appearing in these case studies through an empirical investigation of the BDO dispute as it played out at the Business and Biodiversity Offsetting Programme (BBOP) conference in London in June 2014.

I argue for an understanding of value making in conservation as a performative project through which the values of nature are actively constructed and assembled via social, political and technical processes that can be documented empirically. I emphasise that biodiversity value does not therefore exist waiting to be captured but is actively performed through the assemblages and practices of BDO. The thesis concludes by discussing the implications of a valuation approach in conservation noting the necessary occlusions this sustains and the important changes to biodiversity conservation policy and practice it signals.

Keywords: Biodiversity offsetting, Conservation policy, English biodiversity offsetting pilot, DEFRA, Assemblage, Performativity, Value

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Acronyms

AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Acton Plan
BBOP	Business and Biodiversity Offset Programme
BDO	Biodiversity offsetting
BIA	Biodiversity Impact Assessment
BOMP	Biodiversity Offset Management Plan
BRC	Biological Records Centre
CAA	Clean Air Act
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CIEEM	Chartered Institute of Ecological and Environmental Management
CIL	Community Infrastructure Levy
CIREA	Construction Industry Research and Information Association
COP	Conference of Parties
CPRE	Campaign to Protect Rural England
CSM	Common Standards Monitoring
CSR	Corporate Social Responsibility
CWA	Clean Water Act
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
EAC	Environmental Audit Committee

EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELS	Entry Level Stewardship
EPA	Environmental Protection Agency
FEP	Farm Environment Plan
FSC	Friends of Streatham Common
FWPCA	Federal Water Pollution Control Act
GIS	Geographic Information System
GNW	Great North Wood
HBA	Habitat Biodiversity Audit
HBIS	Habitat Biodiversity Impact Score
HIS	Habitat Impact Score
HLS	Higher Level Stewardship
HMS	Habitat Mitigation Score
IEMA	Institute of Environmental Management and Assessment
IUCN	International Union for the Conservation of Nature
LPA	Local Planning Authority
LWT	London Wildlife Trust
NEA	National Ecosystem Assessment
NERC	National Environment and Rural Communities Act
NGO	Non-Governmental Organisation
NPPF	National Planning Policy Framework
PES	Payments for Ecosystem Services
PR	Public Relations
SACS	Special Areas of Conservation
SANGS	Suitable Alternative Natural Green Space

SCCoop	Streatham Common Cooperative
SMHA	Strategic Market Housing Assessment
SPAs	Special Protection Areas
SPD	Supplementary Planning Document
SSSI	Sites of Special Scientific Interest
TLP	The Thameslink Programme
VNN	Valuing Nature Network
WCS	Warwickshire, Coventry and Solihull
WCS SRGIS	Warwickshire, Coventry and Solihull Sub Regional Green Infrastructure Strategy
ZSL	Zoological Society of London

CHAPTER 1
INTRODUCTION

1.1 A key moment

On a wet summer's day in June 2014, an international congregation of delegates assembled at the Zoological Society of London's (ZSL) headquarters on the outer circle of Regent's Park in central London. The collection of professionals from global conservation NGOs and private consultancies, universities and multinational corporations ranging from fashion to aggregates industries - within earshot of the fading dawn chorus of the zoo's inhabitants - assembled for the first global conference of its kind. The event, *To No Net Loss of Biodiversity and Beyond* was christened as 'the first global conference on approaches to avoid, minimise, restore, and offset biodiversity loss'[1]. The conference was hosted by Forest Trends, The Business and Biodiversity Offset Programme (BBOP) in conjunction the UK Government's Department for Environment, Food and Rural Affairs (DEFRA) and with the ZSL.

Two months prior to the occasion, DEFRA had concluded its official two year pilot study into the feasibility of biodiversity offsetting (BDO) in England[2]. The moment was a significant one, not only for DEFRA, since it coincided with the end of this controversial and perhaps surprisingly high profile pilot period but also for BBOP since it marked a decade long programme of vigorous agenda building, promoting BDO to industry, financial bodies and governments. Arguably, this was also a pivotal moment for the broader international biodiversity conservation sector. As this thesis will show, this scientific and policy field is being profoundly reconfigured through acquiescence to an economic valuation approach under the auspices of BDO, amongst a range of other market based mechanisms within the so called 'green economy' (DEFRA 2011b). Amid the series of technical sessions at the conference covering the methodological and practical matters of BDO policy

[1] http://bbop.forest-trends.org/events/no-net-loss/ (Accessed 17th July 2016).

[2] While the DEFRA is part of the UK Government it is responsible for environmental, farming and rural economic issues in England and independent from the devolved administrations of Wales, Scotland and Northern Ireland. The DEFRA BDO pilot study was therefore conducted in England only.

and practice it was not unusual to hear expressions such as 'nature is the new asset class' or 'give business the right language and stand back to watch it be the engine of change'. This was a conference dedicated to consolidating the seemingly neutral and technical conservation ideal 'no net loss of biodiversity'. Yet, as these utterances testify, it was also, ostensibly, part of a longer epistemic and institutional shift in the conservation institutional landscape towards economic valuation of biodiversity and ecosystem services with market based instruments.

DEFRA's pilot study had attained something of an iconic status amongst the international promulgators advancing BDO approaches. It was expected that the summit would form a platform through which the UK Government would announce its intentions to endorse a state sponsored programme of BDO. Yet no such endorsements were forthcoming. Indeed DEFRA's Secretary of State Owen Patterson did not even show up, foretelling the precarious status for the idea of BDO and its 'practices of becoming'. Meanwhile on the other side of the black capped squirrel monkey cage claiming to 'recreate the Bolivian rain forests as closely as is possible in central London', and outside the fenced enclosures of London Zoo, a smaller but no less committed coterie of individuals convened to conduct a counter forum[3]. The counter-forum's participants from international civil society organisations, academia, journalism and the concerned and interested general public congregated under the banner that *Nature is not for sale!* The attendees of this conference had assembled to resist an agenda that was broadly conceived, through its eagerness to ascribe monetary proxies to economic 'units of biodiversity', to be emblematic of a new paradigm of conservation governance consolidating around the 'financialisation of nature' under the 'green economy'. This thesis seeks to understand this moment in the emergence of BDO policy for conservation and the struggles over its establishment and implementation.

1.2 The DEFRA biodiversity offsetting pilot study 2012-2014

This thesis explores efforts to 'secure the value of nature' (DEFRA 2011b), through biodiversity offsetting in England. It follows DEFRA's two-year biodiversity offsetting pilot study between 2012-2014, initiated by the recently instated Conservative led Liberal Democrat coalition government via the first natural environmental White Paper for 20 years (DEFRA 2011b). This pilot study

[3] http://www.fern.org/publications/presentations/nature-not-sale (Accessed 20th April 2017).

constituted just one component part of a broader repertoire of 'natural capital' and 'valuation of nature' approaches put forward by the White Paper. The Natural Capital Committee (NCC), the formation of which was but one the White Paper's recommendations, defines natural capital as 'those elements of nature which either directly provide benefits or underpin human wellbeing' and as such 'generate value for people' (NCC 2013: 11). The emphasis on capturing and securing the 'economic values of nature' within the White Paper coincided with the themes of the National Ecosystem Assessment released just the month before hand (NEA 2011).

'Ecosystem services', 'natural capital', 'valuation' and the 'economics of biodiversity' - these expressions comprise the contemporary vocabulary of conservation ideas and governance that have ushered in a new era of national conservation thinking in England. The terms are also ostensibly the lexicon that the UK Government drew from in setting about formulating its national biodiversity strategies following commitments made at 10th Conference of Parties (COP) to the Convention of Biological Diversity (CBD) in 2010. In the UK, these approaches were broadly collected under the Government's agenda entitled 'securing the value of nature' underlined by the title of the White Paper that went by this name (DEFRA 2011b).

Framed as an innovation that would help align economic and environmental rationales through streamlining planning, the following statement by Owen Paterson, Secretary of State at the time sets the scene:

> England faces the twin challenges of growing its economy and improving its natural environment. We must be open to new thinking about how our planning system deals with biodiversity if we are going to achieve these goals. Our economy cannot afford planning processes that deal with biodiversity expensively and inefficiently or block the housing and infrastructure our economy needs to grow. (DEFRA 2013: 1)

Government's solution to this impediment was put forward in the shape of a biodiversity offsetting pilot. DEFRA's definition reads:

> Biodiversity offsets are conservation activities designed to deliver biodiversity benefits in compensation for losses in a measurable way. Good developments incorporate biodiversity considerations in their design but are still likely to result in some biodiversity loss. One way to compensate for this loss is by offsetting: the developer secures

> compensatory habitat expansion or restoration elsewhere. (DEFRA 2011d: 1)

Offsetting is therefore predicated on the use of methodologies for technical calculation so as to quantify biodiversity impacts and gains as 'values'. The envisaged benefit to the English planning system is that rather than 'block' development, developers could instead trade these impacts, as values with other actors performing conservation investments elsewhere. In England the basis for calculating these values is the biodiversity offset metric developed by DEFRA, which enables impacts on one habitat type in one location to be 'offset' with another 'habitat type or quality' through conservation action elsewhere (DEFRA 2011d). As a valuation technology (which I label in this thesis as a calculative device), the metric constructs representations of biodiversity debits and credits as 'biodiversity units', which perform as a fungible currency system for the trade of such 'values'.

In parallel to the introduction of offsetting in England, planning reforms delivered through the National Planning Policy Framework (NPPF) in 2012, set out policy guidance for local planning authorities to deliver a 'no net loss' of biodiversity. As a means of delivering biodiversity compensation, the NPPF stipulated that offsetting must observe the mitigation hierarchy, whereby developers should first seek to avoid, mitigate as far as possible and only as a last resort, compensate residual losses with 'offsets' (DCLG 2012: 3). It was envisaged that, 'used in a strategic way', 'offsets could expand and restore the ecological network in England' (DEFRA 2012a: 22).

DEFRA initiated its biodiversity offsetting pilot study to be tested via the English planning system in six local authorities across the country. These local authorities were Devon, Doncaster, Essex, Greater Norwich, Nottinghamshire and Warwickshire, Coventry and Solihull. In addition to these local planning authorities, the pilot also included voluntary 'complementary' pilots, comprising six private sector entities and three local government authorities. More latterly, Network Rail's Thameslink Programme, which at the time was Britain's largest rail infrastructure initiative, was promoted to become the only official DEFRA BDO demonstration project.

In many ways, BDO reflects the continuation of a planning discourse around 'environmental gains' that has been around for over two decades (Whatmore and

Boucher 1993, Adams 1996). As a means of withdrawing the sting of environmentalism as an oppositional standard, 'environmental gains' or 'compensation' can be traced back to the previous DEFRA White Paper, *This Common Inheritance* in 1990 (Whatmore and Boucher 1993). Forms of ecological compensation to mitigate the adverse and unavoidable impacts to sites designated under the European Union's (EU) Habitats Directive have been part of planning policy since 1994. The contemporary manifestation of this longer trajectory, however, is distinct for the calculative precision and market orientation that BDO signals. Specifically, BDO invokes a currency to numerically commensurate losses with gains across space and time to provide 'measurable gains' in biodiversity 'values' (DEFRA 2013), and therefore a 'no net loss' of biodiversity overall (DCLG 2012).

1.3 Thesis justification

A growing body of literature addresses the scientific, political and institutional implications for biodiversity valuations in conservation and BDO policy specifically (e.g. Pawliczek and Sullivan 2011, Maron et al. 2012, Calvet et al. 2015, Apostolopoulou and Adams 2015, 2017, Apostolopoulou 2016). Yet little has been written that addresses the actual valuation process and how offset contracts between impact and receptor sites are agreed in practice. The relative youth of BDO in application means that empirical engagements with the detailed enactments of the policy, its long term implications or conservation outcomes remain limited. Detailed case histories are therefore important to remedy these gaps in the literature so as to better understand how BDO is deployed in practice to better inform debate regarding conservation effectiveness and the implications of the approach more generally. My thesis responds to these lacunae in particular by demonstrating how biodiversity gains or yields were calculated and negotiated for specific offset contracts within DEFRA's government-led pilot study. In particular, my empirical engagements trace the processes of value making in conservation policy and practice and illustrate how conflicts and tensions identified within environmental markets more generally (Sulzman and Ruhl 2000) are resolved by actors in practice.

Beyond these empirical contributions to understanding the specific practices and processes of value making in situ through case studies, the thesis's broader contribution illuminates the specificities of this nascent conservation policy. Its insights are therefore significant to understanding other areas of market based

environmental management or those based on 'valuation'. In relation to a burgeoning landscape of commodification generally of 'species, climate, water, ideas, genomic information' Larry Lohmann (2014: 158) suggests that for geographical research exploring specific empirical fields 'paying attention to particularities and resistances has never been more important'. This thesis is therefore situated in and speaks to a larger body of critical literatures concerned with 'neoliberal conservation', that is, 'the premise that natures can only be "saved" through their submission to…and revaluation in capitalist terms' (Büscher et al. 2012: 1549). My study makes a unique contribution to the expanding interest in the shifting institutional order of this field.

Increasingly, attention is also moving towards value and the practice of valuation as its own unique and lively topic of investigation. This scholarly interest is partly attributable to the 'significant shifts in the valuation of various entities — objects, products services, people, projects, organisations' (Kjellburg et al. 2013). Such shifts often entail the creation of new markets and regimes of value in a range of policy arenas (Bracking et al. 2014). Thus, one of the paradoxes of valuation in public policy that forms the basis of this interest is that 'although more quantitatively defined…the valued entities which emerge often appear to lose their earlier intrinsic value' and thus are rendered more 'disposable than ever' (ibid.: 2). This phenomenon has been articulated elsewhere as the 'tragedy of the well intentioned valuation' (Gomez- Baggethun and Ruiz-Perez 2011). It is these paradoxes that this thesis grapples with through exploring biodiversity offsetting in England. These are also the concerns and interests that shaped the formation of the Leverhulme Centre for the Study of Value (LCSV) of which my doctoral research formed one of several different case studies. The Centre was tasked with understanding how 'valuation technologies [along with] the production of markets and prices…and the quantification of value, legitimacy and care' has emerged in a number of key policy areas across the humanitarian, climate, conservation, water and agricultural policy domains (Bracking et al. 2014: 1).

Anthropologist Daniel Miller notes that 'the word value has a rather extraordinary semantic range in the English language' (2008: 1123) (cited by Castree and Henderson 2013: 28). It is partly the word's polysemy that makes value such a potentially complex but rewarding topic of study as well as such a powerful organising social force. David Graeber (2001) summarises the main ways value is

typically spoken about in social theory into three modalities; moral, economic and semiotic:

1. 'values' in the sociological sense: conceptions of what is ultimately good, proper, or desirable in human life

2. 'value' in the economic sense: the degree to which objects are desired, particularly, as measured by how much others are willing to give up to get them

3. 'value' in the linguistic sense, which goes back to the structural linguistics of Ferdinand de Saussure (1966), and might be most simply glossed as 'meaningful difference (Graeber 2001: 2)

We will encounter each of these forms of value in the chapters that follow.

At the same time, at its most abstract level, value has also recently been defined as the 'quality of being measurable and comparable with other things' (Bigger and Robertson 2017: 68). My thesis therefore takes inspiration from the rich body of empirical and theoretical literature in economic sociology investigating *how* systems of measurement and comparability are enacted and organised and by whom. This approach is enhanced by a theoretical orientation to Marxian political ecology that provides explanatory clarity over why such systems are underway and importantly, attends to their socio-ecological justice implications. The joint endeavor of these two approaches are concerned with exploring the socio-technical processes forming assemblages that enable hitherto un-priced things to move into economic framings, while attending to the implications and consequences and signaling alternatives to such moves. As such, this research enquiry aligns with nascent scholarly interest coalescing at the modes and methods of such practices and the act of valuation itself (Helgesson and Muniesa 2013)

The political possibilities that arise from the study of value are substantial. David Graeber (2001), for example notes 'the ultimate stake of politics is not even the struggle to appropriate value; it is the struggle to establish what value is' (cited by Bigger and Robertson 2017: 68). My investigation is therefore concerned with what the biodiversity 'value' articulated and circulated through BDO policies, actually is. Additionally, by making transparent how socio-technical valuation happens, who controls the process and exactly how the tensions and paradoxes are resolved (or

not) - various openings for political contestation and potential and change may also be illuminated. It is at the intersection of these empirical, theoretical and political interests that my study into value making through biodiversity offsetting is situated and justified.

1.4 Key themes

1. *Performing biodiversity values*

Through the prism of biodiversity offsetting, this thesis studies the practices that make biodiversity valuable. In DEFRA's 2011 Natural Environment White Paper announcing the BDO pilot, the Secretary of State at the time, proposed:

> Government and society need to account better for the value of nature, particularly the services and resources it provides. Valuing nature properly holds the key to a green and growing economy, one which invests in nature - not just for us, but for our children's children. (Rt. Hon Caroline Spelman MP, DEFRA 2011b)

And yet this agenda, and its plea to 'account better for the value of nature' would imply that the biodiversity 'values' have been there all along, simply waiting to be recognised, accounted for and captured. Further, it rests on the implicit assumption that the biodiversity crisis is rooted in a failure to properly cost and internalise what neo-classical economics frames as 'externalities' - those things lying just outside of the economic pricing structures, thereby creating inefficient, partially functioning markets. In contrast to this conjecture I argue for an understanding of value making under offsetting as a performative project through which the values of nature are actively assembled and enacted via social, political and technical processes that can be documented empirically.

I propose that to understand exactly *how* these values appear and what they *do* requires a dissection of the assemblage itself by tracing the assorted array of human and non-human actors of which it is comprised. A starting point for my study therefore exceeds the consideration of human relations and agencies and in parallel emphasises the role that non-humans play. In particular I accentuate the performative and political agencies of calculative devices (Callon and Muniesa 2005). The DEFRA biodiversity metric, conceived to be the quantitative means of achieving the 'no net loss' of biodiversity is the most obvious of these. Along with the metric, I argue that the policy standard and abstract ideal of 'no net loss' of biodiversity is itself one of BDO's most powerfully performative devices, especially

as it is mobilised by conservationists as a moral imperative. BDO need not even exist as official policy once NNL has been adopted. The proliferation of the NNL standard at national, local government or firm level enacts a balance sheet accounting approach to conservation that in turn requires an accounting technology like biodiversity offsetting for its realisation.

Throughout this study, I distinguish between the wider formation of BDO as a policy approach based on accounting technologies and the 'biodiversity unit' as the valued entity it calculates. This distinction aligns with Latour's characterisation of 'metrology', which he proposes 'is the name of a gigantic enterprise to make of the outside a world inside which facts and machines can survive' (Latour 1987: 251). By this account, BDO is a metrological network or assemblage - it is an idea and a policy, a set of standards, a series of technological devices, spread sheets, biological records, maps, ecological knowledges and professionals, market brokers, normative beliefs and moral assertions. 'Biodiversity units' are the commodified numerical representations of ecological debits and credits that the network (assemblage) produces as 'facts'.

Rather than being fixed in place, I demonstrate the ways in which this assemblage unfolds in a processural and dynamic way (Anderson and MacFarlane 2011). Although my research is grounded in specific geographic settings, the entangled connections between the elements of the assemblage transcend scale as they link various places and moments in time. I emphasise that as the assemblage unfolds over time, it is reconfigured through collisions with other assemblages such as local government organisational settings, prior conservation frameworks or English land markets. The result is that the practices constituting BDO are socially and geographically contingent. Biodiversity values are provisional and performed entities. Furthermore, I propose that offsetting is performative in a recursive and circular sense. I show how BDO expands our 'capacity to envision' (Li 2014) biodiversity as an economic abstraction and calculable entity, while simultaneously relying on such frames for its legitimation.

2. *Shifts in conservation practice - the effects of using 'value' in conservation*

As well as illustrating how economic values are made in practice, my study highlights the various consequences of these processes. In particular I trace the wider shifts to conservation practice in England that offsetting is engendering. The first shift relates to offsetting's powers of commensuration forming the basis of biodiversity's economic value making (as exchange value). Drawing from detailed

empirical data I demonstrate the ways in which offsetting is producing surprising theoretical equivalences between sites of biodiversity impact and gain, making two distinct habitats appear the same through representation as a numerical surrogate. I demonstrate the ability of the metric to fabricate numerical abstractions which commensurate distinct biota across space and time. These commensuration processes have a particular utility for planners or developers, since biodiversity, abstracted to universal equivalence can be easily conceptually dis-embedded from its geographic and temporal context and thereby becomes easier to dispose of in planning decisions. I suggest that, in so far as these processes are built on a range of problematic assumptions and technical fantasies they are producing somewhat un-intuitive and ecologically questionable conservation outcomes, which are concealed by the apparent objectivity of numbers.

Furthermore, this new liquidity arising from fabricated, commensurable natures ensures biodiversity becomes compliant with the spatial demands of economic growth vis a vis, infrastructural development. Through the disappearance of specificities and the creation of equivalences, biodiversity offsetting introduces a geographic and temporal flexibility to biodiversity concerns within the spatial frictions of a contested and crowded planning landscape. The second shift to conservation that BDO begets, I therefore propose, is that that contrary to DEFRA's proposal to make space for nature, BDO primarily serves to make space for development.

Thirdly, consistent with the wider neoliberal values that governed the formation of BDO, the approach is pushing conservation in a direction that favours market values as actors search for economies of scale, market efficiencies and value for money in a bid to make offsetting 'work' *economically*. The subjugation of an ecological rationale to an economic one has grave implications for the robustness of the conservation outcomes under offsetting.

3. *Reconciling 'value' with 'values'*

In relation to the prior point, through illuminating the empirical particularities of BDO I discuss how the process is stalked by an enduring tension between the production of economic exchange value and wider 'sociological' values about what is 'right, proper and desirable' (Graeber 2001: 2). As BDO is frequently positioned as a 'quantitative force for morality' (MacDonald and Corson 2012), efforts to secure the value of nature using BDO are situated in moral complexity manifest through the conflict and debate in which BDO emerged in England and continues

to persist. In relation to this dispute, actors tend to articulate biodiversity's 'many green orders of worth' (Blok 2013), some of which are antithetical to quantification. These moral intricacies ensure that BDO is situated within an on going social and political controversy over the appropriate ways to conceive of, value and subsequently govern nature. Various moral framings may de-stabilise and threaten the coherence of BDO in a 'counter-performative' (MacKenzie et al. 2007) sense by reinforcing biodiversity's non-fungibility as well as its geographic, temporal and socio-ecological specificity. In parallel, however, I discuss numerous cases where NNL is frequently elevated as a 'worthy' conservation ideal that necessarily brackets out the wider pragmatic values that shaped its origins. I illustrate the means by which quantitative-moral values, manifest in abstract models like NNL reside on the fetishised neoliberal norms of efficiency and flexibility, making various kinds of business friendly environmental compromises. As such, the moral weight of NNL is uncritically associated with a strong ecological rationale and drawn on so as to legitimate BDO. It is in this way, I argue that the moral frames serve to strengthen the BDO assemblage.

Finally, I show how the broader sociological and political values under which BDO was embraced by the UK government matter to the way the policy unfolds in practice. Overt political priorities for de-regulation, economic austerity and accelerated residential and infrastructure development comprised the higher structuring frameworks in which actors enacted BDO and adjudicated over the policy's value in government. These values underpinned the paradox that BDO came to occupy. The official pilot evaluation report unambiguously indicated that the approach would require more not less regulatory input into the planning system meaning that as a policy, BDO could not prove its worth to government. Furthermore, these higher values for economic development and de-regulation illustrate the risks of introducing the BDO into political contexts, which are likely to exacerbate rather than overturn weaknesses of biodiversity considerations in English planning system. As I will show throughout the thesis, an emphasis on economic valuation served to reinforce rather than overturn prior configurations of power and influence in the planning system to the detriment of biodiversity protection.

4. *Tensions at the heart of the project*

Throughout my empirical examples of value making in practice I show how BDO is besieged by tensions that must be actively worked through or silenced so that the

approach appears logical and coherent for social consensus. Firstly, frictions obscured within the technical calculation practices arise as actors face additional value judgments and struggles over arriving at the 'right' numerical values. Despite the patina of robust quantification underpinning the perceived neutrality of decision making under offsetting, planners instead face the challenge of producing outcomes that are simultaneously economically palatable, politically pragmatic as well as ecologically coherent. Instead of acting as technical means for the standardised production of impartial and objective calculations based on observed site characteristics, the new metrics associated with BDO are being used differently by different actors. Efforts to make the DEFRA metric applicable to real-life planning cases therefore appear as a process of constant iteration, trial and error. Scores are negotiated and adjusted to suit actors with competing interests in negotiations. Such differences in application may be appropriate in response to real-world complexities but conflict with the stated aims in BDO policy design for standardisation and comparability.

Furthermore, concealed within the design of the DEFRA metric are a series of uncomfortable settlements, for example in the search for simplicity, ease of use and economic efficiency thereby compromising scientific precision or ecological accuracy. Lastly, in cases where BDO eventually lead to efforts to initiate habitat banks envisaged to circumnavigate the shortage of supply side offset providers, an allied set of compromises became apparent. Under these circumstances, actors searched for bank sites that offered appropriate legal, economic and administrative characteristics foremost over the ecological features, again significantly compromising future conservation outcomes.

In summary, the enduring tensions over striking the right balance between economic and ecological rationales is consistent with concerns that an emphasis on market values for biodiversity conservation will encourage developers, as purchasers of impact compensation, to push prices downward so as to lower their costs. In doing so, both the quality and quantity of conservation outcomes through BDO may also be reduced. Thus, while BDO is frequently positioned as a win-win policy and means to 'transcend the trade-offs' (ten Kate et al. 2004) between development and environmental considerations, the schism between economic and ecological rationales persists but is often instead displaced from view.

1.5 Thesis structure

To guide my enquiry, in this thesis I ask:

1. How is biodiversity offsetting assembled discursively, institutionally and materially as a governance approach?
2. How is habitat turned into a market good?
3. How do actors manage the tensions associated with the formation of BDO policy and production of the valued entity, the biodiversity unit?
4. And what are the implications of these projects for biodiversity conservation policy and practice?

To answer these questions, I have split the thesis into five parts that are broadly organised according to the chronology of DEFRA's BDO pilot study. Although this structure is more or less shaped by the sites and moments wherein these assemblages converge I address all questions synchronically at each setting.

Part 1 Theorising the nature-value nexus: conceptual and methodological approaches

Following this introductory chapter I situate the research enquiry theoretically in chapter 2 where I introduce the conceptual approaches I draw from to frame and open up my empirical material. These concepts derive from critical political ecologies and post-structural theory. My theoretical approach is a hybrid in the sense that it combines Marxian political ecology with Science and Technology Studies (STS) approaches such as Actor-Network Theory (ANT) and economic sociology. I group these conceptual approaches under the respective titles of abstracting, assembling and performing. The first part of the chapter follows the political agency of abstraction (as semiotic referent) and the work it does with relation to my topics of interest: 'nature', 'biodiversity' and 'value'. I contextualise this literature against other approaches theorising the 'green economy' and neoliberal conservation. My enquiry aims to contribute new insights to the ways in which certain representational and figurative aspects of biodiversity - framed as generalised entities, both non-specific and universally equivalent - can help make sense of a contemporary nature-conservation-value nexus. The second half of the chapter introduces my STS approach under the headings of *assembling* and *performing*. Here I introduce the concept of the socio-material assemblage drawing on ANT and related work on the 'practices of assemblage' (Li 2007a). ANT, along with assemblage theory more broadly, provides the theoretical lens for investigating human and non-human agents symmetrically as 'actants' that form relational topologies. In so far as these socio-technical assemblages have consequences in the world (Law 1999), I take them to be performative. The final

part of the chapter introduces economic performativity theory in order to explore the ways in which BDO assemblages come to perform and thus make the values of biodiversity in practice. The theoretical approach could be summarised as drawing on a range of conceptual resources to attend to the ways in which the 'enactments of nature and enactments of economy go together' (Asdal 2008: 125).

Chapter 3 outlines my methodological approach, explaining the range of qualitative methods I deployed to gather and order my empirical data within the three phases of the research strategy. My methodology consisted of the construction of case studies through repeat visits, semi-structured interviews, participant observation as well as primary and secondary document analysis. I also drew from participant observation and discourse analysis of conferences and events, in particular as the basis for chapter 8. Chapter 3 also details some methodological reflections on research partialities as well as my own positionality in addition to methodological ethics.

Part 2 Assemblages in a socio-historical context

Chapter 4 is my thesis's hinge that provides a historical analysis of the origins of BDO to set the scene for my empirical chapters 5-8. In this chapter I trace the longer tail of the discursive, material and institutional assemblages of valuing nature through biodiversity offsetting. In particular this chapter demonstrates how biodiversity became conceptually 'offsettable' in connection with the emergence of aggregate rules (Sullivan 2017) in US environmental policy in the 1970s. Key to the overall trajectory of BDO are the political origins of what I identify to be the core actants within the assemblage; the policy standards of 'no net loss' of biodiversity (NNL) and the 'mitigation hierarchy'. I trace how these two separate histories conjoined to give rise to the innovation that became known as 'biodiversity offsetting'. Due to their performative effects on making BDO 'thinkable' I label these devices conceptual technologies. Having contextualised the broader paradigm in which the idea of environmental offsetting was conceived, developed and set free from its origins in US environmental policy in the 1970s I subsequently introduce the empirical context for the present investigation. Through the lens of assemblages, the chapter demonstrates how the UK government came to embrace the idea of offsetting and instantiate a pilot study in England. The chapter then presents the case study topic itself; the DEFRA pilot study and the central calculative technology it employs in service to its efforts, the DEFRA biodiversity offsetting metric. The main contributions this chapter make are demonstrating the

performative aspects of two key calculative and conceptual devices: the policy standard of NNL and the DEFRA metric. My analysis of these conceptual-calculative technologies sets the scene for the empirical chapters that follow.

Part 3 The making of biodiversity values in practice

In the second half of the thesis from chapter 5 onwards, I trace the empirical settings within the DEFRA pilot study where biodiversity values are actually made (chapters 5-7) as well as contested (chapter 8). Chapters 5, 6 and 7 present in depth case studies investigating and demonstrating how local government residential planning applications (chapters 5 and 6) or infrastructure developments (chapter 7) were subject to practices of offsetting within the DEFRA pilot study. The chapters each illuminate the practices of value making through BDO *in-situ.* They provide detailed accounts of the translation of ecological data into economic frames through the assembling and then pricing of biodiversity as 'units'. I address all of research questions throughout each case study. As microcosms, each case study presents overarching findings that straddle the others as well as highlighting their own unique conclusions.

Chapter 5 charts my in depth empirical engagement with the Warwickshire, Coventry and Solihull (WCS) arm of the DEFRA pilot study. Deploying the analytic lens of assemblage I explore the background to WCS's local government environmental and planning policy context that enabled it to develop a 'bottom up' approach to offsetting. The next section of the chapter presents the working through of a specific BDO contract in WCS. In particular it focuses on the practices of value making using the DEFRA metric and demonstrates real examples of ecological commensuration that occur through this device. I note various implications and consequences of this commensuration process. This section also explores how the scores and the compensation costs attached to habitat impacts are actively struggled over by different actors in the process. These negotiation processes highlight the ways in which, rather than being a settled technical approach, BDO reflects prior configurations of power within the English planning system. The chapter also traces the shift towards a habitat-banking model in Warwickshire. In so doing, it illustrates how market pressures for delivering economies of scale in offset provision indicate a re-positioning of conservation discourse in line with agricultural production and growth narratives according to a 'good biodiversity yield per hectare'. As well as demonstrating the actual practices of valuation through offsetting, this chapter concludes by illustrating and

expanding a discussion over the significant shifts to conservation policy and practice that BDO is engendering within this county.

Chapter 6 builds on the insights offered by chapter 5 around local government efforts to shift biodiversity considerations under planning towards offsetting. It follows another of the DEFRA pilot sites, at South Devon. Following a parallel structure to the prior chapter, chapter 6 is similarly arranged in five parts. It starts by exploring the professional, political and institutional context of the pilot site and the ways in which these factors shaped how BDO was enacted, noting various distinctions to the WCS pilot. Subsequently, it presents empirical data on the processes pertaining to the biodiversity impact valuations and arrangements for compensation in relation to a residential development of 255 houses. Much like chapter 5, the example brings an actual BDO contract to life so as to illuminate *how* values are made and traded. Throughout this chapter I emphasise the local conservation and land market assemblages to which the BDO assemblage inevitably binds, thereby creating a hybrid form of valuation and ecological compensation as actors attempt to make sense of and 'muddle through' BDO as a new framework. In particular, chapter 6 highlights the local geographical particularities of a disproportionate focus on the conservation of flagship species. In addition, it explores the significance and challenges to offsetting in a landscape peppered with statutory conservation designations, which fall under a different valuation category to the habitats envisaged by DEFRA as subject to offsetting. The chapter concludes by highlighting five core themes exploring the implications for the production of hybrid forms of BDO. It expands the discussion over the various policy implications for efforts to use offsetting, indicated through the specificities of this case study.

Chapter 7 presents the final case study of BDO within this research project and is distinguished from the prior two in that it derives from a voluntary initiative undertaken by Network Rail on the Thameslink Programme (TLP) rail construction project. Since the TLP BDO initiative was a voluntary undertaking on works already with planning permission, offsetting was not therefore conditional on meeting regulatory compliance requirements set by the LPA. So that Government could assess how offsetting might work in such contexts, TLP was quickly adopted as the DEFRA demonstration project within the complementary arm of the pilot study. The chapter explores how actors actively managed tensions related to reconciling business values with biodiversity values. Justification and

legitimation are thus overt themes woven throughout the chapter. The chapter highlights how the production of new corporate subjectivities is central to the realisation of BDO at TLP. The discussion of market-green compromises (Nyberg and White 2013) sets the scene for chapter 8.

After exploring the ways in which market-green compromises are established in enactments of BDO, chapter 7 moves on to explore the specific biodiversity offset process at TLP. This section follows the structural format of the previous two case studies. But in contrast to the prior two, the emphasis of chapter 7 is on the actual delivery of the offset, since receptor sites and an offset delivery partner were identified and employed. Through tracing this process, I discuss practical features and difficulties of the delivery arrangements, which I show were characteristic of the higher structuring values of the corporate and voluntary nature of the programme. Through exploring TLP, I demonstrate how the logic of BDO and the imaginaries of NNL are assembled through mutually circular strategies of legitimation across scales and geographies. In so far as there is a 'global BDO assemblage' then I show how TLP came to occupy an important node within this through its techniques of 'selling success' (Büscher 2014).

Part 4 The moral complexity of biodiversity offsetting

In the last part of the thesis my discussion turns to the discursive and moral tensions sitting at the heart of the effort to value biodiversity under an offsetting model. Chapter 8 engages with biodiversity offsetting as it has played out as a 'dispute' in English policy discourse. It revisits the 2014 BBOP conference that opened this introductory chapter and the public debate the organisers staged *Agree to disagree*: *Biodiversity offsetting in the mitigation hierarchy, opportunity or peril?* Taking this debate as an empirical field site, this chapter charts the various politico-ethical value systems manifesting in conflicts and compromises that animated the dispute over BDO during the DEFRA pilot study between 2012-2014. This part of the thesis temporarily shifts gear away from the assemblage analytic towards the pragmatic sociology of critique, an ethno-methodological twin to ANT which attends to contested norms, moral ambiguity and the fragile character of political reality (Guggenheim and Potthast 2012). Chapter 8 explores how actors try to make sense of what is 'just' so as to dissect the structuring logics and value systems sustaining the controversy over offsetting. The objective is to isolate the specific moral values imbricated within the discursive strategies that function to direct and shape human agencies within the socio-technical assemblage of BDO.

Chapter 8 builds on the findings from two important recent contributions to English BDO literatures (Sullivan and Hannis 2015, Apostolopoulou and Adams 2017) and combines them with the theoretical frames of the pragmatic sociology of critique (Thévenot et al. 2000, Boltanski and Thévenot 1999, 2006) to empirically explore the architecture of argumentation that sustains BDO as a controversy. The chapter argues that divergent ontological foundations of what biodiversity *is* and the ethical frameworks of action they imply (Sullivan 2017) form the basis of the dispute. In addition, the ways in which these different ontological frames appear as compromises with other value systems, or 'orders of worth' (Boltanski and Thévenot 2006) creates a moral complexity that sustains the dispute as an impasse. In summary, this chapter contributes theoretically and empirically grounded insights to clarify and elucidate the value conflicts embedded within efforts to value nature through BDO.

Part 5 Concluding thoughts on an un-official evaluation of the DEFRA pilot study

In the thesis' conclusion, I discuss DEFRA's official evaluation study of the pilot and reflect on the similarities, overlaps and divergences with what I came to see in my own investigation - an 'unofficial' evaluation. In particular, here I frame the differences as those falling under an immanent critique (Castree 2008) as well as an external one (Boltanski and Thévenot 1999). The former reflects on how offsetting ultimately failed according to its own rationale (even if the pilot was a successful process for government to decide about BDO), the latter questions the basic assumptions it was carried by. I then provide a thesis summary so as to thematically group my discussion points and implications drawn from the previous five chapters into an overall presentation of main findings. I close by offering some concluding thoughts and reflections built around my main argument, which proposes biodiversity value making must be understood as a performative project comprised of the social, institutional and technical components of the BDO assemblage.

PART 1

CHAPTER 2
THEORISING THE NATURE-VALUE NEXUS

2.1 Introduction

This thesis investigates practices that make biodiversity valuable. To guide this endeavour, I will address the following research questions: how is biodiversity offsetting assembled discursively, institutionally and materially as a governance approach? How is habitat turned into a market good? How do actors manage the tensions associated with the formation of BDO policy and production of the valued entity, the biodiversity unit? And what are the implications of these projects for biodiversity conservation policy and practice?

In this chapter I identify a number of concepts that are useful for addressing these research questions. I have grouped these approaches under the respective titles of abstracting, assembling and performing. The decision to frame these headings as verbs rather than nouns was deliberate - since the investigative approach is interested in things that agents do, the active processes of assembling the values of biodiversity. The emphasis of this approach is therefore on the emergence of assemblages and their unfolding across time and space as well as subsequent formations and their effects (Anderson and McFarlane 2011). I am interested as to how these formations are sustained and by the refractory processes that threaten to de-stabilise them (Li 2007a).

In this chapter I also introduce various ways in which scholars have already deployed some of these conceptual approaches to my empirical subjects, for example questioning 'biodiversity' (Turnhout et al. 2012, Maier 2012, Fredriksen 2017,), the performativity of markets (e.g. Callon 1998, MacKenzie 2003, MacKenzie and Millo 2007, Çalışkan and Callon 2009, 2010) and the rise of environmental markets within neoliberal conservation (McAfee 1999, Castree 2002, Sullivan 2010, Büscher et al. 2012,). My analytical approach is a conceptual hybrid. The tools I use for opening up my empirical material draw from both critical political ecologies and post-structural theory.

I open my theoretical review with a discussion of 'abstracting', the processes and practices of which I identify to be foundational features for analysing two vast and amorphous geographical subjects: nature and value. I trace abstractions (as stable formations and representational practices) so as to decentre and de-stabilise the meaning of these two subjects. To paraphrase Li (2014: 590), this section serves as a reminder that the words 'nature', 'biodiversity' and 'value' carry with them a cultural baggage that we need to 'make strange again for the purpose of analysis'.

I then move into a discussion of the socio-material assemblage of BDO, drawing on Actor Network Theory (ANT) and related work on the 'practices of assemblage' (Li 2007a). These frameworks trace the coming together of heterogeneous factors that assemble in certain ways with consequences. They provide a context in which to identify the various elements of BDO, namely its actors, discourses, conceptual and material technologies and institutional alliances, which together form alignments and relations that constitute it as an assemblage. Lastly, I discuss economic performativity theory in order to explore the ways in which BDO assemblages come to perform the reality they seek to represent. In other words, this theoretical body of work is interested in how a range of varied practices can bring into being certain things which they subsequently measure and calculate as economic facts. In the concluding section of this chapter I bring these varied approaches together to explain how their mutual compatibilities can shape my conceptual schema of biodiversity value making through BDO in England.

2.1 Abstracting

> abstraction, n.
>
> **a.** The action of considering something in the abstract, independently of its associations or attributes; the process of isolating properties or characteristics common to a number of diverse objects, events, etc., without reference to the peculiar properties of particular examples or instances. Also: the state of being considered in this way; abstractness.
>
> **b.** Something considered or expressed in abstract terms; something which exists only as an idea or in theory; an abstract concept or idea; (also occas.) a visionary or impractical idea. (Oxford English Dictionary, 2017a)

2.1.1 Abstraction 1: The question of 'nature'

Drawing on the intellectual heritage of post-structuralism associated with Foucault and Derrida in the final two decades of the last century, geographers investigating society-nature relations generated an emerging academic field loosely referred to as 'social natures' (Peet and Watts 1996, Macnaghten and Urry 1998). The intellectual energy of this period was influenced by the prior turn in human geography towards Marxist political economy in the 1970s, but was beginning to transcend Marxism's largely structuralist basis (Castree 2000). Within this shift, geographers responded to seminal contributions on the question of nature in neo Marxian scholarship, such as Neil Smith's (1984) *Uneven Development*, which 'provided the building blocks for the conceptual reintegration of nature into critical geographic enquiry' (Whatmore and Boucher 1993: 167)[4]. As these intellectual resources came to bear on the 'question of nature' in human geography, Castree (2002: 112) explains, a theoretical and empirical body of literature on the topic transformed 'in a few short years from one of intellectual silence to a deafening noise'. The prospect that nature is in part socially constituted led geographers to question the ontological polarity of Nature and Society, as capitalised nouns of the Modern Constitution (Latour 1993). Through this intellectual upheaval, scholars identified discourses concerning nature as fundamentally 'artefactual'; as social products fashioned by economic, cultural and scientific representational practices (Braun and Castree 1998). Nature, the narrative went, 'cannot pre-exist its construction' (Haraway 1992: 296).

A broader typology of the social-natures approaches (Demeritt 2002) locates discursive constructionism to be inherited from the linguistic turn in the social sciences more generally as well as Foucaultian concerns with power/knowledge relations. Linguistic and textual discourse as the agent of this construction is characterised by 'frameworks that embrace particular combinations of narratives, concepts, ideologies and signifying practices, each relevant to a particular realm of social action' (Barnes and Duncan 1992 cited by Peet and Watts 1996: 14). Political ecology's interest lies with the political effects of certain hegemonic environmental narratives and discourses (ibid.). Through identifying 'nature' as being constituted

[4] I expand on Marxian political ecology in 2.2.4 below.

by semiotic and textual representations that variously perform it, 'nature' was thus de-naturalised and repositioned as a linguistic and ideational abstraction[5].

I also draw on the first definition of 'abstraction' provided by the Oxford English Dictionary at the opening of this section - as a term of generalisation that operates 'without reference to the peculiar properties' (OED 2017a). Abstraction as generalisation entails glossing over the 'particular instances' of whatever is being described - towards a universal or totalising representation. As I will show throughout this thesis, totalising representations also have consequences. I will expand on this idea in the following section in relation to 'biodiversity' and in the role of abstraction in Marxian understandings of exchange value in Section 2.2.3 - through the making of 'universal equivalents' under commodification.

One of the principal political gains the theoretical concern with the social construction of nature – provided through its problematisation of the ontological separation of nature and society/culture – was to illuminate the power effects of this socially maintained boundary line. Rejecting the notion of a separate and external nature, epitomised in statements such the 'end of nature' (McKibben 1989), was considered scandalous in many ways in the late 20th century, and still is to a degree today (Braun and Castree 1998). But if nature is taken to be a social construction, it can also be seen as an instrument of social power (Haraway 1991,

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[5] I should clarify why I have grouped theories over the social construction of nature under the heading 'abstraction'. While the semantic similarity between 'abstraction' and 'construction' is not comprehensive, there are overlaps in meaning between the two practices, which are important to my theorisation. I take 'representation' to be the signal connection between 'construction' and the definition of abstraction provided by the Oxford English Dictionary that opens this section. In other words, I see both construction and abstraction (both as processes *and* states) as being constituted by and resulting in representational practices. As identified by various post-structuralist perspectives, and expanded below, these representations have 'worldly effects' and political agency. My focus on the construction of nature in this section relates specifically to the second definition of abstraction in the Oxford English Dictionary above, 'something that exists as an idea in theory' - idealism (in contrast to realism). The meaning is clarified by one of the entry's contextual illustrations of its use (the subject matter is a lucky coincidence):

> 1903 Philos. Rev. **12** 620 [Abstraction] That sensible and single picture of that individual tree may, by the mysterious process of intuition that we call abstraction, be converted into the intellectual universal representation of the tree in itself. (Oxford English Dictionary, 2017a)

Escobar 1996, Peet and Watts 1996, Braun and Castree 1998). These developments in political ecology at the turn of the Millennium offered emancipatory potential for both theoretical and social movements in 'third world' socio-natural relations that were undergoing rapid capitalist transformations and development interventions (Peet and Watts 1996). Openings from these intellectual transformations permitted the asking of critical questions such as:

> Who currently holds power over influential narratives? How is this power employed and with what political consequences? What is the 'science' within defined narratives? And what are the ideas of morality infusing narratives and their supporting 'science'? (Stott and Sullivan 2000: 2)

Thus, the consequences of certain environmental narratives bear relevance for questions of socio-environmental justice, which leads to other questions about how environmental change is understood and to whom responsibility is attributed. Such narratives are also significant for ontological assumptions about nature itself. In relation to the expansion and deepening of a capitalist framing of nature under the paradigm of the 'green economy' (section 2.2.4), such questions are just as relevant today. Sullivan (2017) recently reminds us that knowledge and representational exercises contained in environmental and scientific narratives (and in particular those associated with the 'green economy') 'affirm what becomes known ontologically'. Sullivan (2017: 223) writes:

> Ontological assumptions and praxis, then, denote what entities can exist, into what categories they can be sorted, and by what practices and methods they can be known (i.e. epistemology), for participants in a social grouping sharing and negotiating these assumptions.

Assumptions about what nature 'is' matter, since 'categories of being in the world' influence human action and therefore have 'ethical, including eco-ethical effects' (Sullivan 2017: 225). The upshot of what later became dubbed the 'science wars' (Sullivan 2017) was that social influences and interests as well as the institutional contexts of knowledge production shaped which 'realities' were revealed through scientific practices. Through these intellectual upheavals, truth, much like nature, became a contingent and precarious phenomenon (see Bloor 1976, Barnes 1977 for an early iteration of these issues).

Critical realism emerged in response to what many considered to be the over-reach of idealism and constructionist philosophies (Forsythe 2003, Sullivan 2017). If the

post-structuralist branch of scholarship is taken too far, the argument goes, the implications would be unfettered epistemological relativism and the annihilation of scientific objectivity[6.] Critical realist perspectives do not deny the ontological existence of the world but draw attention to the social practice and contexts that represent it. Critical realism – or what David Demeritt (1998) has called 'artefactural constructivism' – proposes that knowledge about nature and the frames and narratives that these knowledges give rise to are constituted both by nature's materiality and agency as well as through socio-cultural and institutional contexts. Critical realism, and, in turn, critical political ecology, integrates a political awareness of environmental conflicts with a realist understanding of environmental change; in other words it promotes 'epistemic skepticism with ontological realism' (Forsyth 2003: 9).

The victories associated with peeling back the layers of representation that come to shape the category of nature and those that advanced through constructivist-realist debates at the turn of the Millennium in the Academy have not yet been translated into policy programmes. In the latter context, nature is still largely conceived of as 'out there' - as 'an assemblage of things independent from society, whose properties… and social utility are revealed by science' (Bakker and Bridge 2006: 8). This is as true for conservation science and practice and its concerns for 'biodiversity', as any other facet of environmental governance. The question of 'biodiversity' thus forms the focus of the next section.

2.1.2 Abstraction 2: The question of 'biodiversity'

In so far as 'Nature' is a meta-abstraction, biodiversity is one too. Post-structural theoretical resources that came to bear on the question of nature are also relevant to the idea of 'biodiversity', as a universal representation of all life on earth (Hannegan 1995, Escobar 1996, Takacs 1996, Farnham 2007, Youatt 2008, Maier

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[6] The political implications for such epistemological relativism are arguably just as problematic as universalism. Science, it would seem, can easily become caught between a double pincer movement comprised of strong post-modern relativism as well as science denialism. The latter is manifest for example in renewed science skepticism of the present US administration, evidenced by the recent announcement to close the US State Department the Environmental Protection Agency. Indeed the term 'post-truth' has become so popular as to be officially incorporated into the Oxford English Dictionary in 2016. These ideas and their relationships to ontology, epistemology and ethics in the green economy are discussed at length in Sullivan (2017).

2012). These resources helped to de-centre and de-naturalise the idea of biodiversity from something that appears in a pre-formed state to the outcome of various social, institutional and material practices.

The expression 'biological diversity' was abridged to 'biodiversity' in the late 1980s (Farnham 2007). Since then, the subject has given rise to a global policy infrastructure and emerged as one of the defining environmental crises associated with late industrial modernity. Alongside the rise of 'biodiversity' as a defining concept for conservation, a small collection of North American scientists were vigorously engaged in enacting a new normatively focused field of conservation biology. Takacs (1996: 2) describes the emergence of this contemporary discipline as an effort by 'an elite group of biologists' who '[aimed] to change science, conservation, cultural habits, human values, our ideas about nature, and ultimately, nature itself'. From the 1980s onwards, the growth in data of genetic and species loss, and concerns over the economic implications (Farnham 2007), shaped the development of biodiversity science as the 'mission driven discipline' (Meine et al. 2006). As such, Maier (2012) argues that as a scientific subject, 'biodiversity' has always been infused with moral arguments, whether or not scientists writing in ostensibly neutral scientific contexts are aware of it. The normative thrust of this scientific discourse is invoked through a sense of urgency surrounding what Martin et al. (2010) identify as the 'preservation of remaining biodiversity'. The ethical assumptions of biodiversity science therefore tend to dwell in the ontological dualism separating nature and society. Normative frames such as 'preservation' are predisposed towards valuing ideals of naturalness over un-naturalness or pristine, pure states of nature prior to human influence (Cronon 1996, Adams 2004, Fredriksen 2016).

Efforts to institutionalise a newly minted expression of 'biodiversity' were focused upon establishing an umbrella discipline to encompass a single unified topic. Early advocates for this scientific and policy subject coalesced around the conceptual aggregation of biotic entities and assemblages across biological hierarchies, temporal and spatial scales into one catch all label. As the abstract concept of biodiversity was institutionalised in the early 1990s, there was a veritable explosion in the number of publications applying the term (Haila and Kouki 1994). Biodiversity loss came to be recognised as but one of several parallel environmental crises broadly considered under the maxim of 'sustainable development' and christened with an official definition at the multilateral United

Nations (UN) Convention of Biological Diversity (CBD) at the Rio Earth Summit in 1992. The CBD defines biological diversity as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (CBD 1992).

I propose three abstractions constituting contemporary 'biodiversity' that are relevant to this discussion of offsetting. The first is related to its 'state based ontology' (Maier 2012). As an umbrella category, 'biodiversity' steadily mutated through policy and popular vernaculars to be conceived as a quantitative measure of a 'thing'. As such, Maier (2012: 11) asks:

> does biodiversity admit of more and less – that is, increments and decrements – in a way that permits orderings – that is, more or less biodiverse states of a place or of the world?

Totalising abstractions 'flatten diversity', and ironically also the scope of entities actually constituting (*bio*)diversity (Sullivan 2017). In this respect, Maier (2012: 9) proposes that mainstream uses of biodiversity contain:

> Category mistakes that reduce biodiversity to and confuse it with biological identity of some one or another of the entities that contribute to its diversity - such as individual organisms or particular species.

It is this unhelpful abstraction that Maier argues sustains flawed statements such as biodiversity (as opposed to particular population of flying insects) provides a pollination service. This is also true for the ways in which biodiversity advocates tend to draw deductive conclusions about causal relationships between one component of biotic relationships with another deemed to be good for humans. To say cows reduce malaria is not the same as biodiversity is good for human health (Maier 2012). Maier's contributions at times appear as pedantic if not hair splitting attachments to the logical fallacies in the concept, and popular deployment in scientific literatures, of 'biodiversity'. Nevertheless, they help to illuminate the 'peculiar properties', (to follow the Oxford Dictionary definition), of biotic entities and their relationships that are framed out of meta-abstractions of biodiversity. The danger, Maier (2012) argues is that 'valuing other things about biotic, sentient entities, creatures or assemblages that have nothing to do with diversity vanish when they are attributed the term 'biodiversity'. He says their 'salient points are obscured or lost entirely' (ibid.: 342). Where does this leave us therefore for

identifying the 'value' of biodiversity. What exactly does valuing 'biodiversity' mean? How does this abstraction come to bear on how value is conceived?

The second abstraction I locate relates to two of biodiversity's sub categories; species and habitats, principally drawing from Fredriksen (2017). Species are the common units used to measure biodiversity (Mace 2014) and are therefore often in practice taken to comprise the sub-collections of diversity in biodiversity. Various authors also locate the category of species to be a powerful abstraction with worldly effects (e.g. Braverman 2015; Lorimer 2015, Tsing 2015). Fredriksen (2017) for example discusses the historical formation and stabilisation of reified and separable 'units' within biodiversity conservation. Fredriksen (2017: 2) writes of the 'rationalising and universalising' aspirations of biodiversity conservation, which 'enact values…through abstract categories of species and habitats'. This relatively recent way of ordering the non-human realm, Fredriksen argues, arose as conservation developed its positivist ontology through scientific practices of measurement. This historical transition in the latter part of the 20th century was characterised by abandoning concern for the 'emplaced lifeworlds' of animals in specific places in favour of biological generalisations of habitats and biologically defined species (ibid.).

Although the categories of habitats and species pre-dated the rise of 'biodiversity', Fredriksen proposes that the institutional and scientific apparatus of biodiversity science exerted a powerful 'organising force in science and policy'. The significance of these generalisations and orderings, Fredriksen (2017: 2) writes, is that they effected 'a commensurability between places and things', rendering categories of animals and plants as interchangeable and exchangeable due to the eradication of the uniqueness and specificity of individuals and their contexts. Moreover, as, Adams and Apostolopoulou (2017) argue, for BDO to appear coherent at all, biodiversity had to first be re-framed discursively as measurable, isolated units, spatially disconnected to space and compatible with price signals. My interest in this idea, along with Fredriksen's and Apostolopoulou and Adams', is in the ways in which prior non-pecuniary value orderings of biodiversity, as abstractions, formed preludes to subsequent market (pecuniary) ones. Market values require and affirm an ontology of biodiversity, in which living things, places, and complex ecological relations are separable into commensurable units of exchange (Fredriksen 2017). I expand on this relationship between abstraction to units, commensuration, exchange and commodification in section 2.2.4, which discusses

the nature-value nexus. I also return to it in chapter 4 through exploring the origins of BDO's unique abstraction as a market-scientific hybrid - the 'biodiversity unit'.

The universalising abstraction of biodiversity is also significant for the 'diversity of practices' in relation to knowing and valuing nature that it 'occludes and displaces' (Martin et al. 2013: 129). As a constructed phenomenon, biodiversity 'perpetuates dualistic thinking' and obscures alternative onto-epistemologies for the non-human realm (ibid.). In relation to these effects, anthropology literatures have examined the ways in which 'biodiversity' forecloses alternative worlds predicated on 'living with' more than human individuals or landscapes, in particular those which constitute animist ontologies (Turnhout et al. 2013, Sullivan 2010, Vivieros de Castro 1998). The 'pacification of lively entities' (Fredriksen 2017; see also Çalışkan and Callon 2010) through technologies that render them visible, knowable and governable reflect classic Foucaultian conceptualisation of biopower (Foucault 1979). In relation to the biopolitics of biodiversity conservation, Escobar (1996: 56) writes of the 'institutional apparatus that systemically organises the production of forms of knowledge and types of power'. This apparatus is comprised of 'international institutions, Northern NGOs, botanical gardens, universities and research institutes in the first and third worlds, pharmaceutical companies, and the great variety of experts located in each of these sites' (ibid.: 56). Youatt (2008) also directly attributes biodiversity conservation to be an exemplary of biopower and contends that biological conservation is a project as much concerning power and political life as scientific endeavour.

The third abstraction is thus related to conceptualisations of biopower, and highlights biodiversity policy and governance apparatus' drive to try and capture the entirety of life on earth through measurement in databases (Bowker 2000, 2008). These governing surveillance efforts are characterised as panoptic in ambition (Lorimer 2006, Youatt 2008). The drive towards measurement is significant precisely for data's amenability to be translated seamlessly into the metrology of the 'green economy'. Relatedly, it has become somewhat of a truism amongst promulgators of natural capital accounting that 'you cannot manage what you do not measure' (often misattributed to author of TEEB Pavan Sukhdev but originally coined by management theorist W.E. Demming in 1994). This popular expression was adapted from new public management (NPM) sciences in business and government (Turnhout et al. 2014).

'Doing' conservation under these institutional conditions depended on 'knowing' biodiversity in ways that were amenable to quantitative measurement and management. Quantification of biodiversity therefore forms the third abstraction I highlight as a representation. Since the CBD in 1992, the majority of conservation practice has entailed the construction of censuses based on measuring and mapping biodiversity as records to be stored in databases and classification systems (Raven and Wilson 1992, Turnhout and Boonman-Berson, 2011). Lorimer (2006) notes that over this period, biodiversity was constructed as a passive, disembodied object revealed through quantitative and classificatory drive of natural sciences. Maps and databases presenting quantified units of nature can thus appear to reflect a flat ontology through depicting continuous and horizontal space (Ellis and Waterton 2005), entirely abstracted from context.

In relation to such flat ontologies, through the numerical and economistic framings of biodiversity as 'natural capital', Sullivan (2010: 122) writes:

> Nature meanwhile, is further abstracted, distanced, flattened and somehow dematerialised; to be valued and exchanged remotely, via the transformation of its sensual and embodied aspects into the transcendent zeros and ones of more easily manipulable digital information.

Biodiversity conservation has thus become primarily concerned with 'technologies and measures such as monitoring, reporting and verification procedures, auditing and performance management' (Turnhout et al. 2014: 582). Economisation of biodiversity therefore could be seen as simply an extension to the quantification practices that came before it (ibid.).

The significance for the discussion above is that each of these abstractions of biodiversity are, in their own ways, preliminary frames for the creation of market values through processes of commodification. Commodification of nature depends on its abstraction from space, time and context (Castree 2008). Before I discuss commodification I will turn towards the role of abstraction in Marxian perspectives on the creation of exchange value for prior context before moving on to the final part of this review; the nature-conservation-value nexus and the political ecologies of the 'green economy'.

2.1.3 Abstraction 3: The question of value

Since this thesis is concerned with the rise of value in nature within the logic of the 'green economy', the value I am principally engaged with investigating is exchange

value under the neoliberal capitalist system. For Marx, the specific value form of the commodity under capitalism is synonymous with exchange value represented as price (Marx 1990 [1887]). In the first Volume of Capital, Marx's theory of exchange value identifies how the material and specific labour contained within a commodity is effaced through its translation into an abstract quantity that subsequently emerges in an equivalent form. The outcome permits the relative (comparative) value of market commodities to become established. Any differences or unique attributes of both the labour or the use value of the product thereby disappear from view and no longer matter under the new calculus of value within a market exchange. Marx writes,

> 'Along with the useful qualities of the products themselves, we put out of sight both the useful character of the various kinds of labour embodied in them, and the concrete forms of that labour; there is nothing left but what is common to them all; all are reduced to one and the same sort of labour, human labour in the abstract.' (Marx 1990 [1887]: 128)

Here, labour 'congeals' in commodities as abstract undifferentiated quantities. Marx proposed that money is the 'representation of socially necessary labour time and price is the "money name of value"' (Marx cited by Harvey 1996: 152). This abstract quantity of 'socially necessary labour time' ultimately functions to create the sense of a 'universal equivalent' through which comparability and relativity can be calculated. As an intentional structure of capitalism, a Marxist understanding of abstraction identifies how the process serves to render irrelevant the 'material properties of the product, the character of the labour, which shapes it, and the nature of the want it satisfies.' (Benton 1989: 70). Instead, the production of capitalist value rests upon the exploitation of 'abstract' labour seeking an overall quantitative increase in exchange value. To Marx (1990 [1887]: 275), capital thus exists as a process where 'it comes out of circulation, enters in to it again, preserves and multiplies itself within circulation, emerges from it in increased size and starts the same cycle again and again'. The central objective therefore, becomes an increase in the quantitative value of money - the specificities of use value are irrelevant.

By ascending to the ultimate universal equivalent, money as capital flattens the world through its ability to abstract and homogenise qualitatively different phenomena and processes able to be exchanged on a market (Fourcade 2011). By acting as a universal equivalent able to effect commensuration across otherwise

different valued entities, monetary valuation is an abstraction tout court. In relation to my conceptual interest in abstraction, Harvey (1996: 150) writes that, 'money is the only well-understood and universal yardstick of value that we currently posses'. This begs the questions, what happens when biodiversity is represented as value through this universal yardstick? What must happen both conceptually and materially for this translation to make sense? What moreover, are the implications?

Harvey's (1996) use of Marxist value theory identifies the precise processes shaping the journey that any general entity must undergo so as to be ascribed value within capitalist relations - that is the act of making a commodity with exchange value. As so far discussed, the historical and social constituents of commodities are obscured through establishing a universal equivalent of exchange value. As such, Marx proposed that people tend to perceive the value of a commodity to reside in the money form (exchange value) itself, rather than its use value or the labour used to make it. This perception endues because the relationship between production and consumption has been severed. As Marx explains this 'mysterious' and 'transcendent' quality of the commodity is a form of 'fetishism'. He writes:

> There, the existence of the things quâ commodities, and the value relation between the products of labour which stamps them as commodities, have absolutely no connection with their physical properties and with the material relations arising therefrom. (Marx 1990 [1887]: 165)

Appearing thus from the alienation that provides a conceptual and physical 'cut' between an object with exchange value and its background production conditions people take what is in fact a 'social relation between men [sic]' to instead be 'the fantastic form of a relation between things.' (Marx 1990 [1887]**:** 165)

Marxian political economy locates the role of abstraction as critical for 'thinking and envisioning capitalism' (Castree 1999: 156). For example, Marxist geographers have long expounded the foundational role of spatiotemporal abstraction in facilitating its processual and self-reproducing structures and systems (Harvey 1985, Lefevbre 1991 both cited by McCormack 2012). In so far as it extends universalising tendencies and serves to elide and obscure corporeal difference and lived experience (McCormack 2012), abstraction within the capitalist mode of production functions to create a certain mode of calculability through fabricated generality. Indeed, the political effects of these abstractions carry a violence (Sayre

1989) that forcibly alienates human labour and non-human bodies from their context. The result is to situate them within a frame of commensurability and comparability from which calculations of exchange value may subsequently be established. My enquiry therefore attends to the potential violence associated with monetary abstractions of emplaced wildlife habitats and non-human natures.

2.1.4 The nature-value nexus and the political ecologies of the 'green economy'

In drawing from a long pedigree of Marxian political economy approaches to understanding the value-nature nexus (Schmidt 1971, Smith 1984, Benton 1989, Fitzsimmons 1989), political ecology is concerned by the transformation to, and co-production of, socio-natures through the dialectical forces of capitalism. Despite their differences, this materialist strand of political ecology is related to the post-structural constructvism described above in its shared interest in overturning the separation of nature from society, exemplified in particular as previously discussed by Neil Smith's 1984 book *Uneven Development*. According to Castree (2000), this was the first time that a 'Marxian theory of nature was not founded on Nature-Society dualism'. Castree (2000: 24) develops ideas advanced in Smith's work on the 'production of nature' - which he explains is 'a continuous process in which nature and capital co-constitute one another in temporally and geographically varied and contingent ways'. Associated with the discursive constructivist positions so far discussed, the social natures in the 'production of nature' are materially *and* discursively constituted and reproduced through the social relations of capitalist production. Thus, 'the major analytical issue from this political economy perspective becomes the question of how nature is (re)produced, and who controls this process of (re)production in particular times and places' (Whatmore and Boucher 1993: 167). Along with an analysis of the construction of environmental narratives (Stott and Sullivan 2000) political ecology highlights the social justice and distributive implications for the transformation of socio-ecologies inextricably bound to and made by the capitalist system. Along with the 'production of nature', much of this literature has dwelled at the downstream impacts of capitalist transformations and the commodification of nature and associated socio-political relations (Robertson and Wainwright 2013).

Latterly, a range of theoretical and empirical contributions have tracked the political ecology of neoliberal conservation (Büscher et al. 2012). Neoliberal conservation 'shifts the focus from how nature is used in and through the expansion of capitalism, to how nature is conserved in and through the expansion

of capitalism.' (Büscher et al. 2012: 4 emphasis added). In their 'synthesised critique' of the field, Büscher et al. (2012: 9), write that neoliberal conservation is characterised by:

> infusing conservation policy and practice with the analytical tools of neoliberal economics, without recognising that these are themselves infused with, and reinforce, particular ideological positions regarding human relationships with each other as well as with non-human nature.

In relation to the idea of BDO, 'the analytical tools of neoliberal economics', under the guise of the 'green economy', frame environmental degradation as connected to a valuation deficit. The premise is that green accounting practices which internalise these unaccounted for 'costs' can rectify the alleged deficit through attributing market prices to hitherto un-priced aspects of nature (that is, those aspects of nature that were previously categorised as 'externalities' within mainstream economic analyses) (Costanza et al. 1997, Daily 1997, Bayon and Jenkins 2010, Helm and Hepburn 2014). The political ecology of conservation is therefore interested by the ways in which environmental economic framings of nature abound within the consolidating paradigm of the 'green economy' (MacDonald 2013, McAfee 1999, Pawliczek and Sullivan 2011, Sullivan 2010, 2013, 2017). Noel Castree (2008) refers to this market turn as the 're-regulation' of the environment according to neoliberal emphases on prices, markets, and private property. In this sense, environmental markets provide an ecological 'fix' (ibid.) to neoliberal capitalism's parallel crises of failing rates of profit and productivity. For example, imputing prices onto hitherto unvalued or un-priced things is purported to achieve duel outcomes. This alleged win-win relates to securing the on-going conditions for capitalist expansion through enlarging the spaces for market exchange and therefore capital accumulation (Harvey 1996, Katz 1998) while simultaneously responding to the biodiversity crisis by 'selling nature to save it' (McAfee 1999).

Escobar (1996) characterises capitalism's interest in conservation as the difference between modern ecological capital and post-modern ecological capital. The latter, he explains 'develops a conservationist tendency, significantly different from its usual reckless, destructive form' (ibid.: 47). The transformation in capitalism's locus of value in nature is in part driven from what James O'Connor (1991) termed the 'second contradiction of capitalism'. This describes the failure of commodity production to account for its external conditions therefore driving degradation and

ecological crises. The contradiction is understood to be capital's inability to fully reproduce nature, which, having been depleted by industrial processes, is increasingly unable to support capital accumulation (ibid.). In this respect, Jason Moore (2014), asks whether capitalism is witnessing the 'end of cheap nature', on which capitalist production depends as input. The counter-point is the end of a 'cheap dustbin' as repository for industrial outputs, such as green-house gas emissions (Emel and Bridge 1995).

The corrective, according to environmental economics, therefore seems to be the further commodification of un-priced, but increasingly 'valued' parts of nature. Along this thinking, the question becomes how nature, conceived as 'externality' can be brought 'inside' economic value calculations. Castree (2003) provides a synthesis of Marxian theorisations of the commodification of nature as being predicated on the privatisation, alienation, individuation, abstraction (functional and spatial) and eventual monetary pricing of nature. This point is crucial to my conceptual repertoire for the production of value in biodiversity. At the risk of it getting lost within this broader theoretical overview, I wish to emphasise the significance of Castree's typology of commodification in relation to the broader concern with abstraction. In particular, I connect this theorisation of commodification with the calculative and framing practices of the DEFRA metric I identify below under economic performativity. The DEFRA metric is the framing device that permits the translation of biodiversity from 'outside' to 'inside' market calculations. The metric enacts the abstractions of biodiversity necessary to be valued with numbers or money.

Neo-Marxian theorisations of the nature-value nexus drawing on the 'production of nature' have also come to recognise the valuation of nature's 'indirect' benefits or services which are sometimes referred to as non-use values (c.f. Mace 2014). Contrary to the role of physical 'natural capital' as a direct input to the technology-land-labour equation of Marxist value theory, the growth of the contemporary 'green economy' is predicated on the valuation of the *non-consumption* of material nature (Büscher 2013, Castree and Henderson 2013), even while so called 'eco-system services' it produces are consumed by society. Optimistically termed the 'new economy of nature' (Daily 1997), in the environmental economic literatures, this approach seeks to create and extract capitalist value through the maintenance of living, standing, flourishing ecosystems. Under this guise, ecosystems are re-framed as stocks of capital and providers of services through their biological or

abiotic functions as constitutive of the broader 'conditions of production' (O'Connor 1991, Harvey 1996), and human wellbeing more generally.

The original purpose of the ecosystem service concept was to be pedagogical and communicative for the cause of biodiversity conservation more generally (Gomez-Baggenthun et al. 2011). It was mobilised through a growing sense of urgency in biodiversity conservation quarters aiming to show how the disappearance of biodiversity directly affects the functioning of ecosystems underpinning human wellbeing and society (ibid.)[7]. The history of economising biodiversity has therefore been summarised as a shift in utilitarian frames used to show why biodiversity matters to scientific debates over which biodiversity matters for services and functions useful to human society and economies (Dempsey 2015). The economistic rationale has arguably always been infused with and drawn from a moral normative proposition as well as a utilitarian one. Throughout this thesis I will show that strategies to promote BDO are no different.

The conceptualisation of ecosystem services proved to be a powerful metaphor (Norgaard 2010) and seductive idea adopted with great speed and with little critical discussion (Adams and Redford 2007). Contemporary engagements with interests in the construction of economic values within conservation have located a putative drive towards the 're-framing of nature to save it' (Apostolopoulou and Adams 2017). Since the iconic and influential Millennium Ecosystem Assessment (MEA) in 2005, value frames of ecosystem services and by extension the whole of the biosphere, have consolidated through the discursive and institutional stabilisation of approaches towards 'natural capital' (Sullivan 2014, 2017). Indeed, natural capital has come to dominate a global institutional policy landscape in what is considered

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[7] Although biodiversity is often used in tandem with the expression ecosystem services they are not the same thing and this is but one of the examples of the misnomers buried within the contemporary reading 'biodiversity' that forms Maier's complaint. Mace (2014) for example explains that while most ecosystem services rely on biological inputs, they also crucially depend on chemical and physical ones. Furthermore, in various cases, the efficiency with which ecosystems can capture and convert energy, decompose and recycle organic material (forming a fundamental ecosystem service) is often enhanced by with low bio*diversity* (Mace 2014). This negative relationship is why Redford and Adams (2009) point towards the risks associated the potency of ecosystem services language. The seductive idea of ecosystem services, they explain can easily lead to overlooking components of biodiversity that are not valued for their role in providing ecosystem services, ultimately risking an 'ecological brittleness' (ibid.) through for example, ideas of redundancy.

to be the greening of capitalism through the costing and internalisation - known as the 'bringing into account' of hitherto un-priced environmental services (see also Helm and Hepburn 2014; Helm 2015). 'Natural Capital' can today lay claim to an expansive global policy and scientific apparatus advanced by nation states, financial institutions, corporate bodies and international NGOs such as United Nations Environment Programme (UNEP) (The Economics of Ecosystems and Biodiversity, TEEB), World Bank's WAVES Programme, International Union for the Conservation of Nature (IUCN) as well as the World Business Council for Sustainable Development (WBCSD). It is spoken about as being a 'revolution in economic thinking'[8] and one in which the UK sees itself becoming the 'world leader'[9]. These narratives increasingly incorporate and make use of a moral justification associated with a 'transformation of capitalism' through efforts to measure and value additional things to shareholder dividends.

Closely related to the broader apparatus of neoliberal conservation and the development of natural capital is the emergence of a field loosely referred to as 'business and biodiversity' (see also MacDonald 2010a, 2010b, Corson et al. 2012, Wilshusen and MacDonald 2015). Geographers interested by the institutional dynamics of conservation policy and practice as an ethnographic research site in itself propose that this field is characterised by strengthening coalitions between conservation biologists, NGOs and corporate business. In addition to these institutional alliances, Wilshusen and MacDonald (2015) propose that the field is formed of three constitutive narratives and conjoined logics, which can be paraphrased as:

- Seeing nature as a provider of goods and services;
- Framing business as relying upon and impacting on these services;
- Advocating for methods to account for biodiversity and ecosystem services so that business can capture and leverage its natural assets as opportunities and reduce material risks in connection to these.

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[8] CEO of the Scottish Wildlife Trust, Jonny Hughes made this point at the closing Plenary address of the World Forum for Natural Capital 24th/ 25th November in Edinburgh http://naturalcapitalforum.com/ (Accessed November 15th 2016)

[9] Deputy Director of Natural Capital at DEFRA, Nick Barter made this point at his keynote at The Wildlife Trust's event *Conservation in the 21st Century: The why, what, how of natural capital* on the 25th November 2015 http://www.wildlifetrusts.org/node/118099 (Accessed November 15th 2016)

In designing compliance and voluntary economic instruments as incentives for environmental restoration in some types and places, in exchange for degradation in others via techniques of trades and offsetting (Wilshusen and MacDonald 2015), actors are said to building 'economies of repair' (Leach et al. 2012). Such economies, through trades and techniques for offsetting, are predicated on a range of conceptual technologies that flow from some of the abstractions this theoretical overview has already discussed. These abstractions are also part and parcel of the conceptual technologies (no net loss, mitigation hierarchy and aggregate rules) that shape how economies of repair (trades, offsets) through their commodification and valuation work in practice. I return to these conceptual technologies in chapter 4.

So as to bring this overview of 'abstracting' and the value-nature nexus in the green economy to a close, it is worth noting here that I have so far been discussing abstraction largely as a noun - a formation. In this sense, I have been concerned by the variety of representations of nature and biodiversity, along with the implications of these representations for their underlying ontologies. Abstraction is evidently also a verb - something that actors do. In taking abstractive processes and abstract representations to be central to the act of producing new value from biodiversity within BDO, this thesis is therefore engaged with identifying the constitutive practices and actors (human and non human) engaged in these undertakings. I trace these acts to be outcomes of and sustained through socio-technical assemblages and performativity. These tools form companion conceptual resources for this enquiry. It is to these literatures that my discussion now turns.

2.2 Assembling

The second theoretical approach I draw from to investigate the practices of value-making and circulation within biodiversity offsetting in England is actor-network theory (ANT) developed by Bruno Latour (1987), John Law (1986) and Michel Callon (1986). Originating as an anti-essentialist, post-structuralist branch of science and technology studies (STS), the central proposition is to overturn binary categories that had hitherto shaped and maintained as separate fields of study - 'scientific' and 'social' analysis. Doing away with these pre-determined categories, ANT instead seeks to trace the associations between the entangled agency of people and things that sustain the Modern dualism. ANT posits that the distinctions that shape pre-given dualisms (human/non-human, agency/structure, truth/falsehood) are not taken to be given in the order of things, but instead must

be taken as 'effects or outcomes' of arrangements and networks (Law 1999: 3). Echoing the literatures concerned with social-natures in the first section of this chapter, ANT rejects that ontological polarity is antecedent to these arrangements. Crucially, non-human beings are treated symmetrically with human actors, each posed as 'actants' – that is, things with different capacities to act within a relational network. Thus, all actants have various kinds of agency although not necessarily intentionality.

ANT is therefore principally interested in methodological approaches to identifying relationality and the shapes, or 'topological' arrangements, of networks that have effects. Disrupting the ontology of agency through the notion of actants returns us to the notion of hybrids and in particular, socio-material arrangements. Due to their interest in socio-material arrangements, ANT and other non-dualist approaches loosely referred to as 'after ANT', share a lineage with assemblage thinking of Deleuze and Guattari (1987). 'Assemblage' is taken to be a rough translation of Deleuze and Guattari's term *agencement*, which has no English counterpart (Callon 2007: 319). Callon (2007: 320) explains, that 'agencement has the same root as agency: agencements are arrangements endowed with the capacity of acting in different ways depending on their configuration'. Thus assemblage (*agencement*) and ANT, are 'concerned with why orders emerge in particular ways, how they hold together, somewhat precariously, how they reach across or mould space and how they fall apart' (Müller 2016: 27). In this sense, and as mentioned at the beginning of this chapter, Anderson and McFarlane (2011) caution against deploying assemblage as a static 'form' and instead recommend that assemblage is considered as practice. They propose the key task is 'to understand assembling as a process of 'co-functioning' whereby 'heterogeneous elements come together in a non-homogenous grouping' (ibid.: 275). Assemblages, they propose, are always under assembly.

ANT draws from more philosophical assemblage theories (for example Deleuze and Guattari 1987 or De Landa 2006) in order to formulate a more grounded approach to empirical analysis. Latour (1999: 9) proposes ANT is merely a 'sociology of associations' or what his colleague Callon (1986) has called a 'sociology of translations'. Translations become an important theme throughout the processes of value-making with BDO as the empirical chapters will show. Latour therefore suggests that, rather than a theory, ANT is more helpfully considered as methodological practice. In this sense, ANT and assemblage

approaches provide 'a way to travel form one spot to the next, from one field site to the next, not an interpretation of what actors simply do, glossed in a different and more palatable universalist language' (Latour 1999: 21). ANT and assemblage thinking inform the conceptual resources as well as the basis for my thesis' empirical strategy. In so doing, I trace the associations and translations between human actors, discourses, institutional networks, and non-human actants comprising English biodiversity offsetting networks and assemblages. I expand on this approach in the methodological strategy laid out in the next chapter. Table 1 presents a snapshot of some of the main human actors (through their institutional contexts) and non-human actants within BDO assemblages in England.

Table 1 Human agents, their contexts and nonhuman actants of the BDO assemblage

	Transnational	UK and England		
		Government (at all scales)	Private sector	Civil Society
Human individuals situated in institutional and organisational networks	BBOP & Forest Trends, international consultancy firms (ecology and BDO specific), UNEP, TEEB,	DEFRA economists and policy makers, HM Treasury, Local Planning Authority (LPA), Natural England,	Developers, consultant ecologists, planning consultants, offset brokers, research consultants (i.e. IEEP)	Conservation and wildlife NGOs, campaign and activists, think tanks, local residents, landowning offset providers, journalists,
Non-human actants; (social, technical, textual, material, normative)	Conservation policy designations (habitats and species) Biological records and databases Texts and planning documents Policy standards Conceptual (intellectual) technologies ('no net loss' and the mitigation hierarchy) Inscription devices, maps and interactive maps (i.e. Natural England's Magic Maps, strategic habitat maps in Local Planning Authorities) The DEFRA metric (calculative device), other calculative devices and equations Computer programmes and spread sheet technologies Material natures, places and geo-physical characteristics of landscapes Wider planning objectives and values Moral framings			

Source: Author

Following Latour's (1993) question, 'what counts as nature?' I ask what must be assembled for biodiversity units and offsetting, the market-based policy approach on which it relies and its economic units to manifest? ANT is helpful to this enquiry since it reveals 'things' to be situated and contingent achievements. In relation to the abstractions outlined in part 1 of this chapter, I draw on ANT as a methodological and theoretical resource to trace how practices of abstraction become meaningful representations (Robertson 2012). The 'socially necessary

abstractions that are adequate to bear value in capitalist circulation' (ibid.: 387) require shared 'consent' to durable, stabilised truths for BDO to assume rational coherence. How is this 'consent' manufactured? Using ANT and assemblage thinking it becomes possible to investigate empirically how this valuation work and the broader political-economic programme in which it is embedded materialises and unfolds. This thesis therefore responds to the charge that while Marxian political ecology enquiries have contributed many insights into 'liberal environmentalism' of market based conservation programmes, very few have focussed on the 'emergence, dynamics and relative durability of transnational, economistic governance arrangements over time' (Wilshusen and MacDonald 2015: 4).

In its 'strong' version, ANT displays antagonisms with critical political economy approaches outlined in the prior section. In this respect, ANT has been criticised for being de-politicised and neutral towards political ecology's core commitments to analysing the overarching drives to capitalist production, accumulation and associated social justice concerns (Lave 2015). Another principal complaint political economy levels at ANT is the latter's conceptualisation of non-human agency. Castree (2002) nonetheless, proposes the perceived incompatibilities between political ecology and ANT to be a 'false antithesis'. Elsewhere, scholars have noted how Marxian political ecology actively enhances ANT through providing a sharper focus on the power relations between actors and the other nonhuman actants they create (Dempsey and Robertson 2012, Christophers 2014, Bigger and Robertson 2017). The important contribution a synthesis of the two theoretical foundations can offer is that an explicitly or implicitly Marxist political economy lens can remain central, 'while multiplying the actors and complicating the politics involved in approaching the society - environment nexus' (Castree 2002: 111). Increasingly scholars are looking at the unique contributions that political economy and economic sociology can offer for the study of value, in tandem. Bigger and Robertson (2017: 72) articulate this combined approach as powerful because:

> Marx's concept encompasses economic and moral valences of value, while valuation studies and STS allow for sophisticated understandings of semiotic valence, the task of creating distinctions between things, performed by people with specific motivations and in particular contexts.

In relation to studying value, they note, economic sociology and STS helps to reveal the questions of 'how' while political economy is adept to attend to questions of 'why', and with what social consequences (ibid.).

Closely related to ANT's methodological approach of tracing relational networks, and processural dynamics of 'becoming' in ANT, Tania Murray Li (2007a: 263) identifies 'practices of assemblage' as 'on-going labour of bringing disparate elements together and forging connections between them'. This weaker version of ANT might also characterise assemblages to be constituted by 'on going processes of reproduction grounded in conditions of contestation, where directionality emerges from the configuration of power relations and agency continually in the making' (MacDonald and Corson 2012: 163). Li (2007a) provides a critical political edge to the possibilities of ANT or its looser manifestation of assemblage in locating the power strategies employed by various actants or agents of the assemblage. For example, the practices Li identifies within the assemblage derive from Foucaultian interests in active power strategies such as 'anti politics', 'authorising knowledge' and 'managing failures' as well as 'rendering technical' with quantification and calculative practices (shown in Table 2). Key to Li's methodological effort is demonstrating how assemblages stabilise. Her empirical engagements trace the production of land as an investible resource (2014) and investment in community forest programmes in Indonesia (2007a). Part of her analytic is concerned with how the latter have been sustained for more than thirty years, attracting vast sums of money and on-going interest (ibid.). In this way, Li demonstrated how the Indonesian community forest governance assemblage was maintained through performative practices that involved manufacturing consent, maintaining stability and durability. In a related way, this dissertation identifies the networks of elements that have given rise to the project of biodiversity offsetting as a proliferating conservation imaginary, grounding itself in distinct administrative processes around the world in spite of scant empirical evidence of its success and indeed widespread controversy.

Table 2 Tania Murray Li's (2007a) Practices of assemblage

'Forging alignments'	'The work of linking together the objectives of the various parties to an assemblage'. Examples of these 'objectives' include efficiency, profit, conservation, sustainability etc. (263)
'Rendering technical'	The process of 'extracting from the messiness of the social world... a set of relations that can be formulated as a diagram, in which problem (a) plus intervention (b) will produce a beneficial result (c)'. I take 'rendering technical' to be similar to practices of abstraction I have so far discussed.
'Authorising knowledge'	'Specifying the requisite body of knowledge; confirming enabling assumptions; containing critiques'
'Managing failures and contradictions'	'Presenting failure as the outcome of rectifiable deficiencies; smoothing out contradictions so that they seem superficial rather than fundamental; devising compromises.'
'Anti-politics'	'Reposing political questions as matters of technique; closing down the debate... by reference to expertise; encouraging citizens to engage in debate while limiting the agenda'
'Re-assembling'	'Grafting on new elements and reworking old ones; deploying existing discourses to new ends; transposing the meanings of key terms.'

Source: Li 2007a: 265 unless otherwise noted

Li's vocabulary of 'managing failures' resonates with my use of 'tensions'. Tensions lie at the heart of environmental markets (Sulzman and Ruhl 2000) and must be actively managed so as to stabilise an environmental market assemblage to prevent it from unravelling. The persistence of these tensions and failures may frustrate the assemblage from ever becoming established at all (Fredriksen 2014). In the following section I expand on these refractory processes as versions of 'counter-performativity' (Blok 2011) in considering what I identify to be de-stabilising tensions within the BDO assemblage. In relation to my third research question I ask, how do actors manage such tensions and with what effect?

Affiliated to ANT is a branch of economic sociology, concerned with the performativity of economic theory. The relational network model is extended under this programme to trace the ways economic frameworks, markets and market goods are constituted by set of performative networks. It is to theories of economic performativity that my discussion now turns.

2.3 Performing

As the third conceptual resource for my investigation into the processes of value making in BDO, I draw from performativity theory within strands of economic sociology developed principally by Michel Callon (1998, 2007) and further advanced by Çalışkan and Callon (e.g. 2009, 2010) and MacKenzie (e.g. 2006, 2009). Associated with ANT and STS, performativity theory in economic sociology is adapted to an investigation of the economy and the formation of markets. Callon (1999: 182) notes 'it would be worrying if ANT had nothing to say about the market when it was all along designed specifically to analyse those imbroglios in which humans and non-humans alike are involved'. The concept of performativity implies that what appears as reality - as the given order of things - is in fact circumscribed by particular socio-technical assemblages. Another word that is sometimes preferred over performativity is 'enactment' (Mol 1999, Fredriksen et al. 2014). As Mol explains, performativity is meant to convey that 'a reality is done and enacted rather than observed' (Mol 1999: 77).

I identify performativity operating in two respects within BDO. The first locates the socio-technical arrangements of BDO as a policy approach and market based instrument of conservation governance. To look at BDO as a policy approach I explore the processes under the heading *Economisation and Marketisation* below. The second process of performativity is concerned with the production of the economic units of biodiversity as BDO's currency, which I address under the heading *Calculating Market Goods*. The two foci of the research relate to my first and second research questions; how is BDO assembled? And how is habitat turned into a market good?

Economisation and marketisation

Drawing from Callon (1998) I interpret the formation of biodiversity offsetting as a market arrangement achieved through processes of economisation and marketisation (Çalışkan and Callon 2009, 2010). Economisation 'refers to the assembly and qualification of actions, devices and analytical/ practical descriptions as 'economic' by social scientists and market actors' (Çalışkan and Callon 2009: 369). Economisation also entails performativity, proposing that 'economics, in the broad sense of the term, performs, shapes and formats the economy, rather than observing how it functions' (ibid: 369). Marketisation, Çalışkan and Callon (2010) explain, is but one modality of economisation. They use marketisation to attach

the wider programme of economic performativity to an empirical context of markets.

It is worth noting that here, that in a parallel to ANT's treatment of non-human agency through its 'hybrid ontology', economisation and marketisation are said to be shaped by social forces as well as materialities which Çalışkan and Callon (2009) label 'techniques'. As these authors (ibid.) explain, a pure sociology of economy would be limited to the discipline's 'favourite objects - networks, social relations, institutions, rules, conventions norms and power struggles' (ibid.: 384). Yet, they say that empirical work increasingly points towards the decisive role 'played by techniques, sciences, standards, calculating instruments, metrology and more generally, material infrastructure in market formation' (ibid.: 384) These materialities, together with social networks form a 'socio-technical hybrid' that works to format and condition market spaces as well as conferring value on 'things'. Through this conjecture, market formations and economic values are taken to be a consequence of socio-technical assemblages rather than a priori reality. Therefore, economic performativity traces the agency of economic actors (both human and non-human) to better understand the work that the profession, its knowledges and tools actively does in rendering things economic.

I extend a similar conceptual approach to BDO in England. In this respect, I take BDO as a market based instrument, albeit one requiring significant regulatory input, to be enacted by a series of performative practices that align actors, discourses, technological devices and mechanisms, policies and institutional logics (see also Bracking et al. 2014). In chapter 4 I trace the conceptual technologies of BDO ('no net loss', aggregate environmental policy rules and the mitigation hierarchy), the institutional alliances, charismatic individuals, frames and discourses of the biodiversity values and material-calculative device (DEFRA metric) that performed the BDO assemblage in England in 2011/2012. I carry this analytic through to examine in depth empirical accounts of specific BDO contracts under the pilot study. This latter element of the assemblage, the DEFRA metric, leads me on to the second scale of economic performativity in BDO.

Calculating market goods

Moving the discussion here to the actual practices of valuation, I draw on performativity theory to attend to my second research question - how is habitat turned into a market good? In this respect, economic sociology offers conceptual resources for how valued entities are defined *in practice*, and thus how the

economic 'x' is made (Callon 2007). The socio-technical hybrids of economisation described above relate to human actors in combination with the application of a material, or calculative devices.

A useful definition of what the device does is provided by Callon and Muniesa (2005: 14):

> Calculative material devices frame the world of possible choices by drawing a boundary between goods displayed and those taken into account. The device therefore is the delimitation of the boundary between goods included in the space of market calculation and those that were excluded.

In this sense, Robertson (2012) rejects the notion that capital simply expands into new frontiers and fields of accumulation in environmental markets. The calculation of value in the first instance entails a series of definitional and representational practices that bring ecosystem services as market entities into being. As Robertson observes, '"the red legged frog habitat" service is not out there waiting; rather it is fundamentally defined as a service in the process of its marketing and sale' (ibid.: 387). The calculative device seeks to achieve standardisation and feasible substitutability between commodities in order to facilitate the equivalence required for trade (Callon and Muniesa 2005). Calculative devices therefore place goods in a frame with other goods to build a relational connection between them. In this way, new types of classification and calculation can occur (ibid).

Bearing direct relevance to the case of BDO and the DEFRA metric, Callon et al. (2007) also refer to these devices as 'metrics'. Metrics work 'for the description and the assessment of products' which 'is a crucial ingredient of the performative processes that shape markets' (ibid.: 9). The key calculative device in this study is the DEFRA metric, although we encounter others such as cartographic and valuation technologies (which interact with the DEFRA metric) in chapter 5. The metric equation is conceived as a matrix and later given effect as an Excel spread sheet so as to process ecological data into market values under offsetting. It is through this device that actors are able to define and measure biodiversity values as individual 'units'. The DEFRA metric, therefore enacts an economic-scientific hybrid entity invented uniquely for BDO, called a 'biodiversity unit'. As a newly minted market good, the BDO currency permits the trade of biodiversity 'value'

between developers and offset providers. I examine how actors utilise this metric in situ across three case studies in chapters 5, 6 and 7 so as to illuminate how a conservation 'valuation' approach is mobilised in practice. In addition to this, I show how associated conceptual frames and vocabulary also do work as discursive actants in commodity formation. Additionally, and in relation to my third research question, I illustrate how conflicts and tensions intrinsic to environmental markets more generally (Sulzman and Ruhl 2000), are resolved by actors in situ.

Counter performativities, tensions and failures

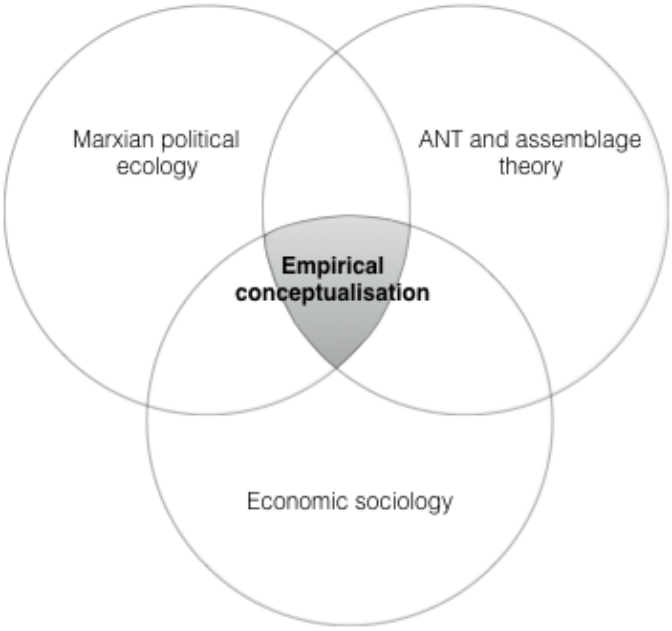
One of the central contributions of performativity theory is to assist in identifying the processes and practices that are involved with 'keeping things going' (Li 2007a). And yet, sensitivity to the active work that constitutes these assemblages should also point to their fallibilities - to the fissiparousness inherent within these processes (Li 2007a, Greenhough 2011). Rather than a monolithic trajectory that is static, performative assemblages urge us to follow how active agents are engaged with keeping things on track. Actants are also engaged with contesting and challenging the course and in so doing triggering various inflections and mutations along the way. The tensions that emerge through counter-performativities must be actively overcome so as to sustain the directionality of the assemblage.

For example, economic performativity and market-making sometimes occurs at sites of intense political contestation (Blok 2011). In relation to the laborious formation of environmental market-making in biodiversity governance, Blok alerts us to the important and influential role that a class of transnational environmental NGOs play in 'practices of contestation'. Blok's (2011) notion of 'performation struggles, as different worlds trying to prevail' asks that we locate and duly recognise actors who articulate alternative visions and value systems. These gestures and strategies of disruption are in large part what I seek to trace in chapter 8 in considering the counter-performative (MacKenzie et al. 2007) tendencies of NGOs and activists weighing in on the dispute over biodiversity offsetting. Blok notes that NGOs as public knowledge brokers in environmental governance can foreground and frame tensions between economy and ecology thus showing that the 'clash of the eco-sciences' is still alive and kicking even if an institutional mainstream points to the opposite.

2.4 Chapter Summary

To summarise, the theoretical and interpretative framework I am using to address my enquiry into biodiversity value and valuation under BDO incorporates a variety of approaches that introduce the discursive, material and institutional agents that form assemblages. Figure 1 illustrates the hybrid conceptual approach in a Venn diagram. Figure 2 below, indicates how I use these resources together in application to my empirical topic.

Figure 1 A hybrid conceptual approach



I opened the chapter exploring how a post-structural turn in human geography underpinned the growth of idealist constructivist approaches in the final decades of last Millennium. The principal gains these constructivist insights offered were to illuminate the political agency of representational abstractions. Through severing the un-mediated link between language and reality, human geography opened up the question of 'nature', challenging the prospect that it could be maintained as a separate category from society. The consequence was to transform nature from an ontological given to a muddled socio-natural hybrid. Additionally, these changes ushered in a fresh approach to political ecology and provided a conceptual armoury resolved on actively politicising debates about socio-natural relations, since abstract representations are not neutral. As a way to organise and make sense of the world, these assumptions and the ethical actions they engender (Sullivan 2017) have agency on our everyday practices and as such, 'worldly effects' (Barnett 1995 cited by Castree 2002). I draw from this spirit of reflexivity over the production of knowledge in the next chapter in discussion over the methods I selected for my study. To advance this theoretical frame I cannot escape the need to reflect on abstractions of my own making.

With the theoretical scene set, I subsequently discussed how 'biodiversity' is thus a socio-natural hybrid comprised of various representational and ordering practices.

In particular, I traced three abstractions. The first is biodiversity's 'state based ontology' (Maier 2012), the conceptualisation of a totalising 'thing' with boundaries. In chapter 4, I discuss the significance for this abstraction in relation to the role of aggregate rules (Sullivan 2017) in BDO and the idea of 'offsetting' interchangeable quantities of 'biodiversity'. I propose that language which permits speaking of biodiversity in quantitative frames of more or less, and ultimately non-specific terms, enables an abstract conceptualisation of exchange. As I will show in chapter 8, the ontological assumptions that these frames affirm are central to the rationality of BDO. Interchangeability is also relevant to the second abstraction of biodiversity I discussed. This is biodiversity's ontology of discrete separable reified units made of species and habitats (Fredriksen 2017).

Finally, I briefly introduced political ecology literatures that are interested in the representation of biodiversity as numbers in databases. The global coding and classification exercise within the science-policy-governance nexus of biodiversity conservation suggests that the development of economisation of biological life and relationships are not novel ideas but simply extensions of a longer trajectory of quantification (Turnhout et al. 2014). I connect these two latter abstractions together in chapter 4 by discussing the scientific and policy hybrid that forms the backdrop to the DEFRA metric. In particular I show how this combination of abstractions interact through the DEFRA metric to produce something called a 'habitat hectare' as a unit of biodiversity value but represented as a numerical surrogate.

Following the overview of abstract representations in nature and biodiversity I moved the discussion to the ways in which Marxian theories of value conceive of exchange value. In particular, I discussed the universalising properties of money as a flat ontology (Fourcade 2011) that functions as the definitive abstraction. The production of exchange value through commodities and the attribution of price forces the 'peculiar properties' of things (originally the social relations of production) but in this case 'biodiversity', to rescind from view.

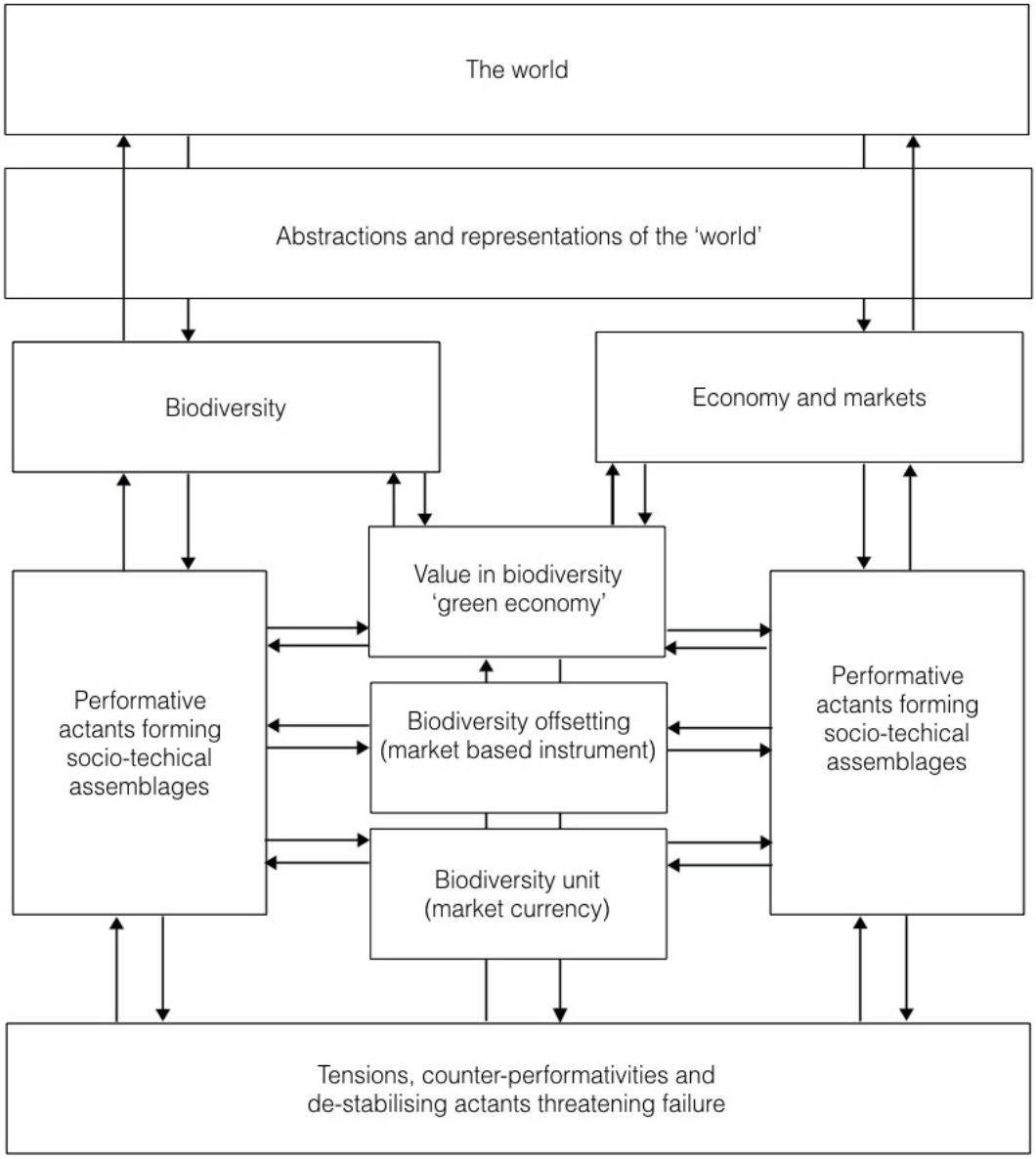
In the final stage of this theoretical approach I combined the abstractions identified in the prior sections to explore political ecology theorisations of the green economy. Here I introduced contemporary Marxian approaches to the nature-value nexus and also more recent interest in the conservation-value nexus.

The latter has been referred to variously by authors as 'neoliberal conservation' (Büscher et al. 2012), or 'post-modern ecological capital', with a conservationist drive (Escobar 1996: 56).

Practices that flatten biotic heterogeneity into discrete and quantifiable units are engaged in building a form of scientific inventory for global governance, as I have detailed above. The propensity for this scientific inventory to convert into economic 'inventory' (Tsing 2015) does not demand such a sizable conceptual leap. I propose that calculating and producing standardised and stable units of nature shapes compatibilities with other flat and interchangeable systems of value such as money. My approach is summarised by Robertson (2011: 388) in discussing the classification and valuation of wetlands as when a 'Derridean concern with the ordering of appearances could speak constructively to a Marxian concern with the constitution of abstraction'. The construction of abstract spaces and the definition of boundaries between types and bits of the biological realm is used to segregate nature out so that it increasingly becomes one that 'capital can see' (Robertson 2006). Therefore, in following Robertson (2012: 388), I propose it is the 'technologies of measurement and abstraction [that] are used specifically to define adequate bearers of value' that render nature visible, and valuable in new ways.

Robertson's interest in the 'technologies of measurement and abstraction' in the production of value brings me squarely to the second part of the theoretical overview. In this section, I turned to theoretical approaches better suited to addressing questions of 'how' (Bigger and Robertson 2017). Underpinning my first and second research questions are sub-questions, such as how is it that these abstract representations of biodiversity emerge and are sustained over time? How do they stabilise as normative facts? Who or what, has agency to accomplish these feats? To address these questions, I zoned in on the conceptual resources that can account for the role of social *as well as* the material components in socio-technical assemblages that have effects. Abstractions form but one of the multitude of actants within the assemblage of BDO. Figure 2 illustrates my conceptual framework.

Figure 2 Conceptual schema of the socio-technical assemblages of BDO



As I have explained, this thesis is concerned with discursive, material and institutional assemblages that convene to perform BDO as a market instrument, and with this - to determine how habitat can become a market 'good'. Additionally, I trace the tensions and counter-performativities that have emerged, and how actors attempt to overcome these in practice. The theoretical resources I have introduced provide me with a hybrid conceptual framework that draws on different strengths of each literature for its explanatory powers. I now turn towards my empirical strategy and explain the ways in which these resources came to inform my methodological approach.

CHAPTER 3
EMPIRICAL STRATEGY

3.1 Introduction

My study into the production of biodiversity values through offsetting under the DEFRA pilot study necessitated a multi-sited approach. The research drew on the analytical frame of assemblages to make sense of how values are made through practices (the production of a 'biodiversity unit'), as well as the broader discursive, institutional and material elements that enabled and influenced these processes (the development of BDO policy). The sites I selected include three case studies, which illustrate the development of BDO contracts at offsetting sites involved in the pilot study. These case studies trace the assemblages of offsetting practices in situ. In addition to these case studies, the research also visits the BBOP/ DEFRA 2014 biodiversity offsetting conference, *To No Net Loss and Beyond*. The latter was an important locus for the broader picture of BDO in England and internationally. Specifically the public debate it staged between advocates and critics of BDO provided a rich empirical site for exploring moral-political value systems in which NNL and offsetting are advocated and contested.

To explain the empirical strategy for this investigation I will first outline my methodology, contextualising my approach within the conceptual framework from the prior chapter. I then justify why I selected my case study sites for the fieldwork and explain the phased approach in which I engaged with them. The next section presents my methods - drawing from interview, document analysis and event ethnography and the means by which I organised, ordered and analysed the data to respond to my research questions. The chapter closes with methodological reflections and a discussion over the limitations of the approach.

3.2 Methodology

My enquiry into the production of value from biodiversity primarily drew on 'qualitative methods to study the quantitative' (Kjellburg and Mallard 2013: 28). Perhaps it is more accurate to describe this research as an investigation into how 'the quantitative' is actually made. Taking my cue from Muniesa (2012, cited by Fredriksen 2014), who argued that such an approach is consistent with a pragmatist tradition associated with John Dewey who emphasises the need to replace the notion

of value (as something that objectively exists) with the act of valuation (as something performed or practiced). The emphasis therefore, is squarely placed on the idea of action - on acts and agency. Thus, as discussed in the prior chapter the starting point for this enquiry is the *agencement* - the active processes of assembling socio-technical hybrids, which have performative effects. The outcomes I am interested in are the ways in which the economic 'x' is made, the processes that qualify things as 'economic' or valuable, which elements or actants do significant work in these relational networks and how. Table 1 in the previous chapter frames the most important actors and actants of the English BDO networks comprising the assemblages my empirical strategy sought to trace. Latour (1993: 20) suggests that to explore the effects of relations coming together under assemblages we must 'leave the confines of intellectual history and pass from the world of opinions and arguments to the world of practices and networks'. It is the practices and networks of elements configuring under the label of 'biodiversity offsetting' that form the basis for my qualitative methodology.

If value is something afforded by the practices of measurement (Mallard 1998, Bigger and Robertson 2017), then the starting point is not so much on what is being valued but how it is *defined* as valuable. In an effort to follow the metrological practices, a large focus of my research is centered on the role of calculative devices (Callon 2007) – as new techniques of quantification. Along with investigating the institutional assemblages such as the arrangements of people, policies, standards, rules and organisations - the research also sought to explore the discursive framings of value and normative and moral imperatives that configure within institutional assemblages. For example, I was interested by how actors managed tensions or barriers to their attempts to value biodiversity through offsetting such that the socio-technical network was extended and BDO continued to appear coherent. In other words, how was an ethical consensus built?

In mapping these networks of relations, Latour (2005: 27) suggests that the researcher should start 'in the middle of things' and then travel from 'one spot to the next'. For the purposes of my enquiry, however the starting point was necessarily the specific sites enrolled as pilot participants of the DEFRA study (shown in Table 3). The DEFRA pilot *sites* were my gateways to the assemblages of value making in situ. So as to observe the specific practices of valuation empirically, I needed to get close

to the actual valuation processes. My intention was to observe how numeric and economic values were made and then travelled through the network, how they were translated at certain points across elements and between actors. The way these processes unfolded over time shaped my research design and underlined my reasons for exploring offsetting through in depth case studies and specifically those where a full offset contract was underway. A methodology that entailed the building of detailed case studies over a period of many months allowed me to observe the contextual content of BDO contracts in specific places and document the complexity and changes over time. The building of case studies also provided a means by which I could follow the production, negotiation and circulation of values empirically and entailed following the relevant actors and actants and their work. Detailed case studies were appropriate because thinking about value in terms of assemblage requires a focus on actual situated practices and relations (Fredriksen 2014: 4).

Table 3 The DEFRA pilot sites

Local planning authorities	Devon	1. Exeter and East Devon Growth Point 2. South Devon 3. North Devon UNESCO Biosphere Reserve
	Doncaster	
	Essex	
	Greater Norwich	
	Nottinghamshire	
	Warwickshire, Coventry and Solihull	
Complementary pilot sites	Atkins	Construction
	Aggregate Industries	Mineral extraction
	Balfour Beatty	Construction
	Eco Box and Code 7 Consulting	Ecological consultancies to large residential developers
	Golder Associates	Mineral extraction
	Somerset Biodiversity Partnership	Range of local authorities, private entities and conservation agencies
	Worcestershire County Council	Local authority
DEFRA demonstration project	Thameslink Programme	Rail infrastructure, south-east of England and London

Source: Author

To explore the production of value under offsetting in the DEFRA pilot I selected three pilot sites as the basis for detailed case studies. I built my first two case studies around the Warwickshire, Coventry and Solihull (WCS) and South Devon pilot sites (chapters 5 and 6 respectively). These two sites comprise two of the six overall local government planning authorities (LPAs) participating in DEFRA's study shown in Table 3. The third case study (chapter 7) is based on a voluntary private offsetting arrangement within Thameslink Programme (one of three contemporary infrastructure operations within Network Rail). I provide contextual detail for each case study at the beginning of the chapter in which they are presented. The latter

case proved an important counterpoint to the prior two cases in that BDO here was entirely unrelated to obtaining planning permission, existing as part of a voluntary corporate sustainability agenda. The rationales, actors, processes and broader context are therefore distinct at Thameslink Programme to the others. This makes chapter 7 comparatively interesting and relevant to understanding the implications for value making in conservation in a voluntary capacity. Thameslink Programme was also significant to the DEFRA pilot study since it became the official demonstration project and therefore assumed an elevated position overall.

Before moving on to describe my methods for building the case studies as well as some of the ethical and political components of this empirical work, I will briefly outline the phases of my research to explain how I selected these case studies within the broader outline of my methodology.

Phase 1.

In the preliminary round of research I sought to familiarise myself with the DEFRA pilot and to initiate the sampling process for the development of detailed case studies later on. Between April 2013 to January 2014 I interviewed individuals from the ecology or green infrastructure departments of county or district councils where pilot sites had been established. Of the six overall pilot sites, during this stage I made contact with five pilot leaders as well as an Environment Bank officer located at the WCS pilot. I also interviewed five individuals from four of the seven complementary pilot sites. It became apparent during this preliminary phase that little in the way of actual offsetting had been initiated during the pilot period. There were also considerable disparities between different sites within the pilot - some had almost no practical experience to report and in these cases my interview questions necessarily dwelled over my respondent's views on and expectations for the policy as well as the reasons for a the slow development of offsetting.

I had originally envisaged that I would develop six cases of specific offset contracts. Although, almost two years into the DEFRA pilot study, not a single site had achieved a full offset contract where the units associated with development impacts had been matched to units created at a receptor site. This disparity in progress between sites as well as the paucity of actual offset contracts forms part of the story in the chapters that follow. Following these preliminary interviews and the associated desk based research, I selected two of the DEFRA pilot sites as well as the DEFRA

demonstration complementary site (Thameslink Programme) for the compilation of detailed case studies. My selection was based primarily on the comparative progress of these sites in trialling offsetting. By progress I refer to the availability of data and evidence pertaining to the scoring and negotiation processes involved with biodiversity impact as well as receptor site biodiversity unit calculations. Settling at three rather than six case studies also seemed appropriate given the unexpected richness and detail of each.

The liveliness and the fast paced nature of the policy field underlined a perceived time pressure to begin interviewing very early on in the overall doctoral research. The two year DEFRA pilot had already been underway for eight months when I started my PhD and I was anxious to allow myself the time to follow arrangements during the pilot period. Jumping in at this initial phase proved extremely valuable for guiding my research design and bringing some of the relevant empirical literature to life in tandem with this initial data collection. In particular, I was inspired by Morgan Robertson's (2000, 2004, 2012) work that followed the practical and political processes involved in the construction of wetland mitigation markets in the US.

Contrary to my early concerns, however, there was no actual 'cut off' point from April 2014 when the pilot finished and when offsetting would suddenly end. Indeed much of the actual data that I collected and present within this thesis was connected with events towards the very end of and after the pilot period as the LPAs were just getting their projects underway. The official pilot phase revealed as much about the barriers to shift LPA institutional processes towards offsetting as actually doing it, perhaps even more.

Phase 2.

After selecting my three in depth case studies, between January 2014 to January 2016 I made repeated site visits to observe BDO related scoring activities and negotiations at the three sites. During these visits I conducted semi-structured interviews (see Table 4 below in Methods), examined planning documents and biodiversity impact assessments (the DEFRA metric) as well as observing public planning committee meetings. This triad of methods formed the basis of my three detailed case histories that tracked the design and development of offset contracts in England from 2013 to early 2016. I examined the processes used to make biodiversity calculations so that biodiversity values could be referred to in terms of losses or gains (or yields) and

prices could be assigned to different sites in the offset agreement for a particular offset contract. These values and prices were often negotiated over a period of months.

I drew on multiple sources of data. Text and talk communications with respondents included semi-structured and un-structured interviews as well as quicker 'catch ups' via emails or telephone calls. Document analysis was central to filling in knowledge gaps or showing me where a lot of the action had happened. I analysed planning documents accessible from the local planning authorities' web portals, campaign group web communications and consultant ecologist reports to describe the development site and to present in detail, the metric calculations in the biodiversity impact assessment (BIA). I frequently relied on documents that my respondents sent me, such as PowerPoint presentations of talks they had given or in-house analysis they had undertaken on the actual BIA spread sheets. I also focused on the negotiation process that ensued regarding the levels of mitigation and compensation payments required and on the biodiversity yields projected to arise from these transactions. I followed the specific roles of actors, how these changed, which new actors were enrolled and why.

The research data collection triangulated (Denzin 1970) across numerous sources and several methodologies to build a detailed comparative case study analysis of different pilot study areas. I conducted 46 interviews over phases 1 and 2, with many of them repeated with the same respondent. For example, I spoke with the South Devon pilot lead five times. This total interview schedule breaks down as nineteen with WCS, fifteen with South Devon, six with Thameslink Programme and six with the complementary pilots. The total sample size of respondents was 26, which comprised nine respondents in Devon, eight in WCS, four at Thameslink Programme and five from the complementary pilots.

Phase 3.

A third and on-going research phase entailed; textual analysis of documents connected with BDO policy in England more generally, further interviews with four stakeholders unrelated to specific offset arrangements, and the collection of data from participant observation at relevant events and conferences. This phase was weighted towards the latter approach with a focus on event ethnography. In general,

it was concerned the wider assemblages of BDO away from specific value production within the contracts at DEFRA pilot sites.

I expand on the interview, textual analysis and event ethnography methods below.

3.3 Methods

Interview

Having identified case studies and individuals to interview, I approached my respondents through email or telephone to explain the nature of the research and request an interview. If they accepted before the research started, I sent a plain language research summary and an ethics consent form, explaining the right to withdraw from the process, research confidentiality, anonymity[10]. The data collection entailed repeat calls or visits across all the DEFRA pilot sites selected for in depth observations and interviews. I repeated the interviews with the pilot leader or another central respondent but I frequently also visited the area of the pilot, if only to get a better sense of actors' organisational settings as well as to observe the context of development sites in question. Looking back now, it seemed naïve to imagine I would be able to perform repeat interviews with the same person monthly or bi-monthly. Such a frequency would have been an impossible demand for my key respondents and in any case, given the snail pace at which things were moving I doubt how much there would have been to actually follow. I cross-referenced what I was finding out in the interviews against public planning archives and findings from interviews with other stakeholders (e.g. the developer or the local residents). Questions and interview style were oriented towards identifying the 'what', 'how', 'who', 'why' and 'when' aspects of both the impacted site under planning as well as the proposed offset sites.

During the interview, things frequently emerged that I had not anticipated, requiring me to think on my feet so that the interview could flow. If a new actor had entered the picture (as was the case in Warwickshire when an offset broker was sub-contracted) I allowed my sample to snowball. The goal was to assemble as much

[10] The names of my respondents have been anonymised in this thesis, however, for the purposes of presenting the case study contexts, the locations and organisations have not been. Nevertheless, I have and will continue to anonymise these other factors for published work, such as Carver and Sullivan (2017) and Carver and Sullivan forthcoming.

technical information as possible over a period of time regarding both sites of impact and gain and to obtain the metric data for the ecological loss, the baseline and target improvements to understand the way that 'value' was transferred. Very often it was difficult to get at specific facets of this datum as one respondent would suggest I needed to gain permission from another before it could be released. Examples might include Biodiversity Offset Management Plans or offset price data. Since elite interviewees are typically connected to each other through larger networks and structures (Cormode and Hughes 1999), many of my respondents were already in touch commercially or professionally. These connections meant that I needed to display sensitivity to the power relations and hierarchies between respondents as well as being discrete about my conversations with other individuals involved in the same planning case.

I generally aimed to meet respondents face to face and on such occasions I was usually hosted at their offices. Occasionally an interview took place while walking around an offset site, a local café or eating sandwiches outside on a summer's day (I have already noted that LPAs are time poor and a quick lunch might be the only way to achieve a diary slot). Quite frequently an interview would include speaking with two people at once if both respondents had been involved in the project. These group interviews inevitably became more conversational. Except where it was impossible (due to a technical hitch or sound interference) I recorded the interviews and transcribed them as soon as possible afterwards. The time it took to transcribe the interview permitted me to reflect on and develop closeness to the data and consequently enabled me to begin identifying themes as the case study narratives were emerging.

I organised interviewees into stakeholder categories (regional and local government, the private sector and civil society) and nine subcategories (see Table 4). In referring to interview transcripts throughout the thesis, stakeholder categories for the DEFRA pilot sites are abbreviated to indicate the pilot site they relate to (of the six local planning authorities [LPA] that took part in the pilot). The complementary voluntary pilot site is denoted by TLP (Thameslink Programme). Sequential codes for interviewees follow the format of stakeholder sub-category, the individual within that site, and date of interview and the pilot site (e.g., LPA3-SD 130515 means the third individual interviewed within the LPA stakeholder category at South Devon, on 13 May 2015). In the Thameslink Programme case study, which was a 'complementary'

(non LPA) pilot in chapter 8, I use the acronym TLP to denote the actors associated with this (CE-TLP 241114, indicating the TLP consultant ecologist on 24 November 2014). Interviews with individuals not directly connected with the any of the DEFRA pilot sites are coded according to their institutional attachment but without a DEFRA pilot code, e.g. WCS, SD or TLP, attached to them, but simply a number to differentiate different individuals.

Table 4 Category and subcategory of case study interviewees and category code

Categories	Sub categories			
Regional and Local Government	Local Planning Authority (LPA)	Natural England (NE)		
Private Sector	Developers (DEV)	Consultant Ecologists (CE)	Planning Consultants (PC)	Offset Brokers (OB)
Civil Society	Conservation and Wildlife NGOs (NGO)	Local Residents (LR)	Landowning Offset Providers (OP)	

Source: Author

Although the data I present in the case study examples are built from three main pilot sites, my insights benefited from the broader data set collected from phase one.

Document analysis

As already discussed, my research relied heavily on document and textual analysis, which frequently included analysing both documents' content as well as their format. This included analysing different versions of the filled out DEFRA metric for the specific cases I was following. Sometimes referred to as the 'Biodiversity Impact Assessment' (BIA) and presented in Excel spread sheets, these documents contained all of the biodiversity impact, mitigation and target creation scores for development or offset sites. Sometimes these spread sheets stretched over three or four pages. I printed and cello-taped these pages together so as to make detailed notes, calculations and comparisons on. I found that I needed to frequently oscillate between these texts and artefacts and my interviewees who may have created the documents so as to follow up on questions that the texts opened up. Other texts I analysed included official central and local government policy documents, policy

reports, digitalised planning data archives containing all the documents created over the course of the planning process (usually in an overwhelming quantity), newspaper or web news articles, professional association and industry white papers and NGO and academic texts.

The offset process generated its own specific paper trail. Apart from the Biodiversity Impact Assessments already mentioned, this included Biodiversity Offset Management Plans (BOMP). BOMPs stipulate the proposed habitat creation work along with the administrative and governance arrangements for the offsets. BOMPs might also contain the itemised costings of the habitat creation work (the offset). Other documents I analysed included local biodiversity offset strategies and policies.

Event ethnography

So as to better understand the wider institutional and policy landscape associated with the development BDO in England I immersed myself in relevant policy events and conferences. Here I took inspiration from the emergent and vibrant methodological field of event ethnographies (Brosius and Campbell 2010, Campbell et al. 2014, Corson et al. 2014). I treated these events as windows into the politics of the development of scientific, policy and corporate networks comprising the consolidating field of NNL and biodiversity offsetting (Campbell et al. 2014). Such events after all, are important 'nodes' in BDO networks (ibid.), where epistemic communities align and where their 'ideological work is partly done' (Campbell and Brosius 2010: 247). Meetings are also active political spaces and technologies of spectacle (Campbell et al. 2014, Wilshusen and MacDonald 2015,) since they are frequently designed to build legitimacy over the topic for which they are convened.

Events also formed a methodological focus for exploring the way actors were related to the to specific case studies I present, through the way they engage with public platforms to reach wider epistemic BDO communities, often across professional sectors. Studying these contexts entailed tracking actors' public communications and analysing the content of their presentations and PowerPoint slides. Throughout the research period, I was also a frequent virtual attendee of BBOP's community of practice webinars and in particular those webinars hosted by individuals connected with my three case studies.

The full list of events I attended as a participant and observer exceeded those relating

to BDO and NNL but related to the broader field of business and biodiversity and specifically the valuation of 'natural capital'. These events included both 'insider' events for BDO's epistemic communities, as well as campaign and activist related civil society events. All of the conference field sites I attended are listed in Table 5. While this thesis presents data from the NNL Summit and the Counter-forum in June 2014 my reflections and insights are built from observations collected from the broader series of events. While I attended conferences ethnographically, sensitive to their 'inner dynamics of micro politics' (Schatz 2009: 305), I also conducted structured discourse analysis on the public debate at the NNL Summit. Read through the lens of the pragmatic sociology of critique (Boltasnki and Thévenot 1999, 2006) this discourse analysis forms the basis for my investigation into the architectures of argumentation sustaining the political-moral dispute over biodiversity offsetting in chapter 8. I transcribed the recording of the debate published on the BBOP website as the basis of the data. So that this research method can be read closely with the theoretical literatures it is informed by, I describe the pragmatic sociology of critique more fully in chapter 8.

Table 5 Author participation in 'valuation of nature' conferences 2013-2015

Event	Date	Location
Civil Society Consultation Event on Biodiversity Offsetting, hosted by FERN International and Re: Common	24 & 25th October 2013	Brussels
The (first) World Forum for Natural Capital, hosted by the Scottish Wildlife Trust	23 & 24th November 2013	Edinburgh
Nature is Not for Sale! Civil Society Counter Forum, hosted by FERN International and the World Development Movement	2nd June 2014	London
To No Net Loss of Biodiversity and Beyond: The first global conference on approaches to avoid, minimise, restore and offset biodiversity loss, hosted by BBOP, DEFRA, Forest Trends and ZSL	3 & 4th June 2014	London
Workshop on Systems Change, Natural Capital and Policy Making, hosted by The Natural Capital Coalition	30th July 2015	London
The World Forum for Natural Capital, hosted by Scottish Wildlife Trust	23 & 24th November 2015	Edinburgh
Conservation in the 21st Century: The why, what and how of natural capital. Hosted by The Wildlife Trusts	25th November 2015	Edinburgh
Strategy Meeting on Biodiversity and Carbon offsetting, hosted by Re: Common and Counter Balance	7th December 2016	Brussels

3.4 Ordering the data

Managing and categorising data using CAQDAS

The data coding to enable the creation of concepts and categories and their comparisons (Bryman 2012) was assisted with a cloud based CAQDAS (computer assisted qualitative data analysis software) called Dedoose[11]. I uploaded data sets of interview transcripts, relevant texts, documents and passages, field notes, and those from planning archives to the programme so as to '*label*, *separate*, *compile* and *organise* the data' (Charmas 1983: 186) (emphasis in original). As a means of ordering

[11] www.dedoose.com

and structuring the data, Dedoose enables close scrutiny of the transcripts for comparative analysis. In addition, the software's data visualisation features enable the creation of a range of charts and graphics that are downloadable so as to identify patterns. The paradox of using a coding and classification approach, however, in a study considering the performativity of measurement systems and the occlusions sustained by categorisation was not lost on me. During my use of Dedoose I discovered that the process of imposing categories and codes depends on drawing sometimes unstable boundaries and frames around ideas, equating loosely connected concepts with others and systematically generalising and abstracting upwards in the search for meaning and order.

Writing up

Along with the coding exercises on the software programme Dedoose, many of my insights emerged through the writing up of case studies into narrative chronologies. The organising and arranging of triangulated sources of data over three years of research into narrative story lines was a painfully slow process but thereby also a productive form of analysis. The mere challenge of ordering the data into coherent narratives enabled a certain closeness such that I could spot patterns and themes often without the help of the Dedoose. For this reason, I found Dedoose to be less useful for the compiling of the case studies. Where it was invaluable, however, was in the structured textual analysis of the transcripts from the debate at the NNL Summit comprising chapter 8. During this analysis I subjected the data of the debate a series of inductive and deductively originated codes for the purposes of quantitative comparison.

Many similar and overlapping themes emerged from the case studies, which indicates that in unity, the explanatory capacity of these cases are greater than the sum of their parts. For this reason, throughout writing this thesis I deliberated over whether to present my data thematically or as bounded individual case studies. I opted for the latter because the story lines and temporal components were crucial to contextualise the nuance of the practices actors were engaged in. Thus, while there are divergences and distinctive features within each case study, several patterns stood out across all three pilot case studies.

3.5 Methodological reflections

Reflecting on my own practices of knowledge production is consistent with the post-structural and critical approach that this enquiry draws from (Rose, 1997, Burawoy 1998, Peck and Theadore 2012,). My reflections were oriented towards both ethical and methodological issues. A preponderant theme for this reflection was the issue of 'researching up' (Smith 2006), by focussing on the policy 'elite' (Cormode and Hughes 1999, Smith 2006, Hanson, Thiem and Robertson 2010). In particular I was interested in the difficulties associated with engaging with critical political, potentially even 'oppositional' research, as well as my subjectivity and positionality (Hanson, Thiem and Robertson 2010). The individuals participating in my research were, for the most part, occupied in positions of relative seniority and power, as central or local government officers, senior NGO conservation personnel, consultants and managers. David Mosse (2006) writes about the tensions that emerge as fieldworkers inadvertently betray the trust, rapport and confidence they have deliberately or inadvertently established with respondents as they distance themselves from the process while performing the analysis.

Some interviewees were more guarded than others, NGOs and private sector organisations for example tended be more restrained, LPA's less so. All the same, I was surprised and grateful at how amenable and generous many of my respondents were, indeed this fact can not be overlooked in considering the biases within the case study selection. As described above, I selected case studies based on the pilot site's progress and experience with offsetting. Inevitably this latter point is in no small way related to the active and motivated individuals who were involved there, who *because* of their personal/professional interest in BDO were also often open to and cooperative with my research. Some individuals were eager to share their experiences and thoughts, almost pedagogically or perhaps in relation to a sense of public accountability. Some people felt that I was doing important in-depth work, similar to the official DEFRA evaluation, or even better than it. In one instance a Wildlife Trust ecologist commented that no one had ever asked her such questions and commended me for the detail I was searching for in relation to the processes. Several expressed an interest in seeing my research after I finished.

I used this eagerness to my advantage to build rapport with my respondents and sometimes acted as a sympathetic ear to the frustrations they faced professionally. Yet, for these reasons I often felt conflicted over the tensions this dynamic opened up

with respect to undertaking 'critical' analysis. I usually responded to an interest in my published work with a polite detachment. I was concerned that my respondents would feel disconcerted by the content of my critique and my apparent lack of sympathy to their 'will to improve' (Li 2007b). Tania Murray Li (2013) reflects on the relation between fieldwork involving policy professionals and critique. My concerns about feeding back my published work to my respondents was perhaps appropriate since Li (2013: 234) notes that 'programmers [tend to] tolerate critique only so long as it can be translated back into programming'. I revisit the question of critique and the specific contributions my study makes to understanding the DEFRA pilot in the final chapter.

Even though many people expressed interest in participating in my research, sometimes the practical realities of doing presented barriers. The repeat nature of the visits proved challenging. Local authority professionals are often time poor and not altogether willing or able to participate in lengthy and repeat interviews over time. Furthermore, the high level of interest in the pilot scheme meant that other researchers were frequently approaching the same people exacerbating this prior predicament. This research interest originated from other academics as well the official pilot evaluation consultants.

During and after the pilot period, BDO emerged as a highly politicised and contested policy approach. Chapter 8 for example is wholly based on the controversy and conflict that BDO was situated within. While some of my research participants perceived BDO to be transformative in its potential to address the dire nature of biodiversity considerations under English planning policy, most were also aware of the scrutiny and critique the approach was attracting, in particular from a range of mainstream media articles from 2010 onwards. The highly politicised currents in which the policy was situated became relevant to my methodological approach. For example the pilot was also attracting a lot of attention and many emails requesting interviews went ignored or were declined. Notably Tom Tew, CEO of the Environment Bank informed me the brokering organisation had received so many requests for interviews, their new policy was to refrain from participating in research at all. I was fortunate in this respect, since I had already formed a relationship with one of the Environment Bank officers at Warwickshire County Council. Even so more

than once, people I approached for an interview attempted to group me together with another researcher who was also seeking an interview.

In response to some of the barriers around gaining access to my interviewees, I became adaptive and opportunistic. This included being highly amenable to fitting around busy work schedules and sometimes meant a quick catch up call or email as an expedient way to keep up with what was happening within pilot site contexts. I discovered that just making contact often yielded a new planning reference number, a heads up over a forthcoming public meeting or an online document that I could follow up with. The difficulty around gaining the access I needed also led me to initiate a 'shadowing' exercise with LPA officers. I planned for this kind of micro-ethnography (Bryman 2012) so that I could perform participant observation in addition to performing interviews. In one instance I helped an LPA officer try to make sense of the opaque guidance provided by DEFRA and experimented with cartographic representations of biodiversity impact and mitigation that could be translated into the metric's values. Nevertheless, this approach proved to be somewhat of a methodological false start as the practices of offsetting in reality take place in ad hoc and disjointed moments throughout the longer working day, often in solitude behind a desk. Actually *doing* the work of offsetting might be an email conversation (as negotiation) or a telephone call, yielding nothing particularly observable for the researcher other than the paper trail or oral account. Biodiversity offsetting, it turns out, is predominantly an administrative exercise.

As my response rate to requests for interview was patchy, my sampling process necessitated a similarly opportunistic approach. Meetings and conferences were useful places to bump into professionals who would otherwise have been too busy or difficult to track down. Furthermore, the 'networky' and social atmosphere of such events helped me to build rapport with people and thus the likelihood of obtaining at least one interview with otherwise busy professionals. Indeed such events also provided me with opportunities for casual conversations and a chance to soak up the atmosphere, write ethnographic field notes or follow developments outside of the confines of the formal, scheduled interview. The research process was messy and I can't deny that luck didn't also play a part. I met one respondent, central to the Thameslink Programme case study in a lunch queue at The Wildlife Trust's 2015 conference on Natural Capital in Edinburgh. I tended to participate in industry

events either as a participant or volunteer organiser, somewhat further confusing the distinction between occupying the roles of programmer or critic, identified by Li (2013).

3.6 Conclusion

Research Partialities

Inevitably it was impossible to ensure that as a researcher, my own rhythms perfectly aligned with those that I wanted to learn from. One of the disappointments of the research was not being able to observe the ecological ordering practices of the actual biodiversity surveys and metric application first hand by accompanying the ecologists to development and offset sites. This was perhaps an unavoidable consequence of the case study methodology, where I was committed to following the specific chain of events, individuals and processes in connection with particular offset contracts or pilot sites. For the three case studies presented within this thesis, I found that I had already missed the actual ecological surveys assessing the baseline and target biodiversity value surveys to be translated and processed through the DEFRA metric. The ecological survey is a vital part to their story and no doubt would have been illuminating for understanding the practices and paradoxes of biodiversity valuation under offsetting arrangements (c.f Robertson 2004, 2012). As such, while in no way a complete substitute for actual participant observation I was left with secondary accounts of the process and their resultant inscriptions and documents with which to work. While the case study approach and my focus on whole BDO contracts produced rich data, methodologically it was also sometimes limiting in terms of what could be covered, geographically or temporally. I was interested in the sequences of events for specific contracts and was therefore committed to following certain cases over time, sometimes at the expense of starting new enquiries elsewhere to plug gaps that I couldn't close with my chosen examples.

Nevertheless, the commitment to building detailed case studies entailing repeat visits and the successive tracing of things over time revealed many of the things within the case studies that would have been lost from a synchronic or snapshot window of fieldwork. All the same, the period of fieldwork was actually very short in planning timeframes and too brief to be able to observe the material biodiversity outcomes of offsets (although we do encounter offset woodland planting in chapter 7). Developments, and thus their actual offsetting works, may not start for many years

after they have been awarded planning permission and this is notwithstanding the broader difficulties with finding actual offset sites I have already discussed. In any case, it would take many more years after offset initiation to be able to observe biodiversity outcomes arising from the habitat creation and management programmes under an offset. As such I was not able to follow the material conservation outcomes of a BDO in action, an issue ripe for future research.

I should also flag that the case studies built around the pilot sites are inevitably going to be somewhat anomalous examples of BDO practices in England. Firstly, offsetting in these sites was a highly experimental project. The approach was new and many of my respondents were still getting to grips with what it entailed and how it could work. A noticeable feature therefore of the research process was the anxiety people seemed to feel about 'getting it right'. This nervousness was particularly pronounced with respondents from NGOs who were often conflicted over their involvement in the first place (explored further in Chapters 6 and 7). Since the examples I was following were associated with a pilot programme, furthermore, (and in the case of the TLP, was DEFRA's *official* demonstration project) the planning cases under consideration were receiving perhaps a disproportionate level of attention and more than local government planners or consultant ecologists would ordinarily be able to afford for other developments or future cases with BDO. In so far as I document various limitations of BDO, this latter point would seem to highlight the potential risks for offsetting generally weakening the overall process for meeting biodiversity considerations in planning, that is already showing signs of resourcing strains (Oxford 2013). Furthermore, the dynamic and emergent nature of the new policy field meant that novel systems, policies and operations were always under development throughout my research period. Even if I had a positivist commitment to the research, the shifting nature of the field would make the process impossible to replicate.

Finally, it cannot be overlooked that the sheer facet of being observed probably affected the nature of what I observed as my presence, in some small ways shifted the nature of the assemblage. As I have mentioned, I was not the only one doing the observing, but my research overlapped with the official DEFRA evaluation study and high academic interest generally. In my methodological travels from 'one spot to the next' through network analysis, I became conscious that I was gathering my own assemblage as well becoming one element within the one I was tracing. In light of

this growing awareness, it seemed increasingly relevant to reflect on the performative role that academics and scientists can play through studying their topics of interest. Irwin and Michael (2003: 113) for example note how 'academic analysis is part of the production of particular versions of public and science and, therefore, of the hybrid admixtures that make up the assemblages themselves'. In its strong version, ANT thus 'collapses the distinction between epistemology and ontology, arguing that the network constitutes the world itself' (ibid.: 357).

Thus, while this facet raises important methodological questions, it also yields political ones. I would suggest that such political openings are both emancipatory as well constrictive. As discussed, academic practices and knowledge making can themselves become imbricated by 'intervening in the world' (Asdal and Marres 2014). Such interventions may 'challenge, de-stabilise and disturb…raising the possibilities of new relationships and associations' (Greenhough 2011: 137). Haraway (2008), for example suggests social scientists scrutinise their own complicity towards building the assemblages they are studying and in so doing attend to the political opportunities this offers. Conversely, interventions could serve to consolidate and actively close down political opportunities by overstating the significance, size or hegemony of the subject of research. Dempsey and Suarez (2016) for example, discuss the ways in which both advocates and critics of ecosystem markets tend to inflate the proposed size and trajectory of such markets. This point seems especially relevant for BDO, since it was an idea conceived by policy entrepreneurs and later picked up by academic scientists, rather than the other way around (Calvet et al. 2015a). Today, BDO is the topic of a burgeoning literature, not a small part of it written by individuals wearing multiple caps - as natural scientists but with other professional interests in the approach, as biodiversity brokers, consultants or policy advisors. This issue is picked up and further discussed in chapter 4, to which I now turn.

PART 2

CHAPTER 4
ASSEMBLAGES OF BIODIVERSITY OFFSETTING AT DIFFERENT SCALES

> It is an interesting coincidence that what might be called economic 'netting', the process of summing losses and gains to arrive at a final (neat) figure, seems here to overlap so closely with mechanical 'netting', as in capturing something desirable in a mesh, filtering away extraneous material or liquid. (Sullivan and Hannis 2015: 11)

4.1 Introduction

The aim of the 'no net loss' (NNL) of biodiversity and the calculative means of achieving this is one of BDO's unique and defining features. The seemingly innocuous insertion of the word 'net' to the otherwise conventional goal of reversing the disappearance of species, habitats and ecosystems with whom we share (increasingly shared) this planet, single handedly enacts a balance sheet accounting approach in conservation. This proposition forms the crux of the chapter and sets the scene for the empirical chapters that follow.

In tracing the etymological roots of 'net', Sullivan and Hannis (2015: 11) note that the idea of 'netted' natures within BDO's manifesto (and increasingly, wider conservation discourse generally) is steeped in 'evaluative content'. I argue here that NNL makes the idea of trading and exchanging different individuated bits of nature 'thinkable'. In so far as NNL plays a performative role in contemporary efforts to calculate and measure impressions of a 'balanced, final and conclusive' state of biodiversity, we can say that it does work - NNL acts. For the purposes of my assemblage analytic, tracing the 'who's' and the 'what's' of assembling the economic values of biodiversity under BDO, I label NNL as a 'conceptual technology' - an abstraction that performatively shapes the world in its image.

How did NNL stabilise over time and appear in England's biodiversity strategies in 2010? Perhaps more importantly, under what conditions did this conceptual technology emerge and what can these origins tells us about its meaning? To return to net's etymology, this chapter follows the mesh-like nature of the contexts in which

NNL circulates and sticks in place and time. The chapter traces its inscription into policy documents and invocations through persuasive discourses at all scales of biodiversity governance. 'No net loss' is not intrinsic to conservation policy or a natural and intuitive ethical commitment to biodiversity. The moral weight of the NNL of biodiversity was constituted by and further enacts political relations between people, persuasive discourses and, of course, metrological technologies as the calculative means of delivering it. Efforts in 'netting out' natures rely on quantitative equations. This chapter traces the origins of the idea of NNL and accountancy approaches to calculate the values of biodiversity. The chapter opens by exploring the origins of 'aggregate rules' (Sullivan 2017) in US environmental policy in the 1970s and closes by investigating the UK government sponsored 'DEFRA biodiversity metric' deemed to maintain an aggregated 'net' quantity of biodiversity.

In the first section of this chapter, I trace the origins of NNL as part of a wider set of principles known as 'aggregate rules' (Sullivan 2017) that appeared as neoliberal inventions within US environmental policy-making in the 1970s. Most accounts of the history of biodiversity offsetting trace its origins to the Clean Water Act (CWA) in the 1970s (Pawliczek and Sullivan 2011, Calvet et al. 2015), but it is helpful to go back a little further so as to understand the theoretical and political ideals that the NNL of wetlands themselves emerged from. I chart how these innovations came to form the conceptual and policy foundations for wetland mitigation markets, species and habitat banking and, later, the invention of biodiversity offsets.

Following this extended history I turn my attention to the ways in which NNL was detached from its regulatory context in the United States in the early 2000s and forged to a corporate social responsibility (CSR) agenda in the extractive industry sector. In particular, this section focuses on the agency of BBOP, as a newly formed institutional body and its role in advocating for BDO markets. The charismatic individuals engaged at BBOP deployed various discursive strategies to mainstream BDO as part of an agenda seeking to reconcile business with biodiversity conservation at a time when the extractive sector was coming under fire from civil society campaigners.

In the second half of the chapter, I move the focus of the discussion to the UK scale to introduce the arrival of BDO in England when the Conservative- Liberal Democrat Coalition Government came into power in 2010. Since the premise of my thesis is that

valuation should be understood as a social exercise (Muniesa 2011), the socio-political contexts in which 'valuation' is embedded and its desired political goals seem to me, to be crucial. This political period in England was a unique moment whereupon a variety of elements converged to propel BDO up the conservation agenda, just as the two year DEFRA pilot study was announced and initiated. Here we encounter NNL again and explore how it became attached to biodiversity conservation policies in England. I focus initially on how this new policy standard was inscribed into a multitude of reports and studies that frequently recommended biodiversity offsetting as government's number one conservation priority. I also chart the role of charismatic individuals as agents, actively promoting BDO through institutional alliances and studies - and variously 'authorising knowledges' (Li 2007a). Within this relatively small community, I frame a 'revolving door' of individuals, many of whom were also connected to the transnational scale of BDO, helping it to re-scale in England and at EU levels. Throughout this section I contextualise the development of BDO within the social, political and ideological dynamics of the moment. The coalition government came into power amid a wave of iconic environmental commitments, declaring that theirs would be the 'greenest government ever'. But overwhelming priorities for 'economic recovery' following the Global Financial Crisis (GFC) of 2007 shaped a climate of further de-regulation and austerity and ultimately the grounds on which these commitments would fizzle out. I argue that the DEFRA pilot study was initiated at the junction of these political imperatives but in the end the primacy of HM Treasury's de-regulation agenda prevented DEFRA from adopting BDO as policy. The expected costs for developers were simply too great to stimulate a political appetite for extra regulatory frameworks. 'No net loss' as a policy standard however, remains in place. The significance of this detail will become apparent in chapter 5 and picked up again in the final chapter.

In the concluding section of this chapter I turn towards the central material calculative device of this study - the DEFRA metric. In this section I outline the metric's development and design principles and expand on how it is able to produce something called a 'biodiversity unit' to act as BDO's market currency for trade. I consider the existing conservation legislation on which the metric is based to establish the terms under which biodiversity habitats are made to appear numerically equivalent with one another - and the translation processes this entailed. My presentation of the theoretical and practical development of the DEFRA metric forms

a backdrop to my detailed empirical observations for how it is deployed by actors in situ, through chapters 5, 6 and 7. But first we need to go back to the beginning of the story to see where it all began; 1970s Washington.

4.2 The rise of BDO's conceptual technologies

Aggregate rules in early US emissions policy

The moment is 2nd January 1970 and President Nixon has signed into legislation the Natural Environment Policy Act (NEPA). By the end of the year, Nixon will have created the governmental department - the Environmental Protection Agency (EPA). In the long shadow cast by Rachel Carson's *Silent Spring*, the world was waking up to the dawning ecological crisis associated with the rise of intensive agriculture, industrial capitalism and rapid post-war economic growth. Following the creation of NEPA, a series of seminal environmental legislative Acts were passed. In 1970 President Nixon initiated the Clean Air Act (CAA) as well as the Federal Water Pollution Control Act (FWPCA) (which later became the Clean Water Act in 1977), as 'action forcing regulatory strategy' (Liroff 1986 cited by Lane 2012: 589). The Endangered Species Act (ESA) followed shortly thereafter, in 1973.

The origins to the logic of *netting out* aggregated sums of environmental 'goods' and 'bads' can be traced to the entangled histories of some of these pivotal pieces of environmental legislation. Struggles over the growth of environmental regulation and implementation of new emissions reductions standards under the CAA triggered a backlash from industry and economists and catalysed the initial regulatory compromises with business interests (Bonneuil 2015, Lane 2012, Voß 2016). Through being framed and thus denounced as an exemplary archetype of inefficient 'command and control' regulation, by 1975 the EPA was forced to accept 'controlled breaches' in the CAA emissions targets. The growing festishisation of 'efficiency' underpinned the framing of a binary narrative with expensive and inefficient command and control policies on one side and flexible, business friendly market based approaches on the other (Lane 2012).

These ad hoc assemblages, arising from struggles to shape environmental regulation and its norms underpinned the emergence of something entitled the 'bubble policy' or a 'no net increase' as part of the CAA's controlled breaches in emissions reductions (Lane 2012). The 'bubble' is predicated on harnessing the concept of an aggregate total of environmental pollution as a limit or 'cap'. These policy innovations

constituted for the first time a quantitative device with the principles of flexibility and exchange of environmental good for bad baked in. By conceptualising a cap, it was deemed that firms could more efficiently and cheaply decide how or where to cut emissions on their own terms (Lane 2012). Where this 'cap' may eventually prove impractical for business it was amenable to be supplemented with principles of exchange and offsetting and thereby conjoined with 'trade' underpinning the formation of early emissions trading markets (Bonneuil 2015).

The key neoliberal innovation therefore lay in the act of separating the means of regulation from the ends (Lane 2012). Under these arrangements these firms were no longer regulated on specific mitigation activities (the means) but on emissions outcomes (the ends). The objective of this de-coupling was to enable conditions of flexibility and voluntarism at the level of individual firms in respect to meeting overall capped emissions thresholds. The cap, i.e. the 'end' to be reached, was the regulation but the means of meeting this were flexible and voluntarily decided. An EPA press release from 1979 described this new framework as an 'innovation inducing, cost cutting 'bubble' policy allowing industry management to figure out the best way to clean up air pollution at individual plants' (EPA 1979: no page). EPA Administrator at the time, Doug Costle argued, 'We'll get further by regulating the results, not means' in what he considered 'will prove to be the most important single reform of the regulatory process' (EPA 1979: no page). The capitulation, therefore of environmental policy to 'aggregate rules' and market based instruments, was in fact a reform to make environmental policy compatible with capitalism and enacted according to entrenching neoliberal orthodoxies of firm flexibility, efficiency and voluntary compliance.

'No Net Loss' and mitigation banking

In a related history to the compromises reached through the CAA detailed so far, Robertson (2004) discusses the trajectory by which the 1977 Clean Water Act (CWA) shaped the landmark innovation that was an equivalent compromise to the 'no net increase' in emissions – namely, the 'no net loss' of wetlands. In 1972, Section 404 of the CWA stipulated that developers seeking to build on wetlands must seek permit approval from the Regulatory Branch of the local District of the US Army Corps of Engineers (COE) (ibid.). After consulting with the regional EPA office, the US COE would either grant or deny permission to developers. But, there was also a third way.

The COE might permit development on the condition that the developer would create compensatory wetland habitat so as to 'offset' the losses *(*ibid.*)*. This innovation was characterised as the 'regulatory basis that prohibits an activity…and later permits it conditionally' (Sulzman and Ruhl 2000 cited by Walker et al. 2009: 149).

Although compensatory mitigation for wetlands had become a common practice by the 1980s, it was subsequently scandalised by a range of field reports that showed that many of the mitigation sites had never in fact, even been created. Environmentalists were outraged and developers were frustrated with the slow and rigid framework of Section 404 (Robertson 2004). Regulators were therefore under cross fire from both groups (ibid.). What followed is a turn of events that strongly foretells the ways in which BDO emerged in the UK two decades later where a political economy of economic competitiveness provided grounds on which regulators sought to build in greater flexibility and compromises to environmental regulations.

Just as the housing industry was applying pressure to the EPA to de-regulate and streamline Section 404 of the CWA through attributing its recent mitigation failures to centralised and inefficient command and control policies, the EPA was gathering steam to initiate its 'National Wetlands Policy Forum' in 1987. Drawing from experiences of mitigation banking from a pilot programme with Tenneco Oil in Louisiana and the first State level wetland offsetting legislation in New Jersey, the Forum arrived at a set of recommendations that concluded that the EPA's policy going forward would be based on the 'no net loss of wetlands' (Bonneuil 2015).

The CWA adopted the aggregate principles but instead inverted the maximum 'cap' of emissions under the CAA's bubble policy and set the threshold as a minimum baseline under which quantitative acreage of wetland habitat should not fall. The power of both policy innovations was their ability to invoke threshold baselines (as maximum or minimum quantities) over or under which the overall quantity of environmental goods or bads should not exceed. The concept of the baseline, as well as the establishment of a common unit of measurement as I will explain below, becomes the conceptual backbone to the idea of quantitative environmental mechanisms and their drive towards commensuration of dissimilar things through universal exchange values. Shortly after the National Wetlands Policy Forum in 1988

(soon to become President) George H.W. Bush adopted the 'no net loss' of wetlands within his policy campaign to promote himself as a business friendly, free-market environmentalist, changing forever the representation of wetlands (Robertson 2000).

As well as setting up an intellectual and discursive framework for an entire generation of environmental trading policies to ameliorate regulatory restrictions on development, the NNL innovation triggered opportunities for 'for profit' conservation actors and stimulated a new industry of environmental credit providing businesses (ten Kate et al. 2004). Under these new frameworks, landowners could now profit from producing and selling environmental (wetland or more latterly, species) credits from their land. Robertson describes entrepreneurial individuals who sprung up to help the development community appease the requirements set by the US Army Corps of Engineers in S404 of the CWA. Early commercial wetland mitigation banking was, by this account, largely initiated through a series of coincidences 'extended by personal relationships and geographic proximity' of key catalytic individuals rather than an overt fiat of a neoliberal state (Robertson 2004: 364). As I will illustrate is also the case for BDO in England, the history of wetland banking, Robertson argues, is a contingent one. Spontaneous innovations by entrepreneurial individuals, collaborative regulators and an enabling geography of federal regulatory agency offices in the Chicago area shaped the wetland banking assemblage (ibid.).

The birth of conservation banking in California followed a similarly happenstance turn of events (ten Kate et al. 2004). Inspired from wetland mitigation banking, (Pawliczek and Sullivan 2011) species banking was formally introduced in the State of California in 1995 and deployed at a federal level in 2003 (Bonneuil 2015). Species banking subsequently developed the Safe Harbour Programme (SHP) so that landowners could profit from the presence of endangered species on their land and thus provide an economic incentive to maintain protected species habitat rather than develop it. The US Fish and Wildlife Service would measure and then limit developers' liability to an established baseline of endangered species. Any surpluses (net gains) of species numbers that the landowners could demonstrate could then be sold as 'species credits' to developers seeking mitigation values for habitat impacts. The Safe Harbour Principle was deemed to act as economic compensation to the landowner for not comprising the protected species ecosystems through development. In their 2004 report discussed above, ten Kate et al. (2004) propose

that the SHP rules set the stage for the creation and the use of biodiversity offsets and mitigation going forward.

A hybrid model: 'no net loss' with the mitigation hierarchy

The ushering in of a NNL policy in relation to wetland ecosystems and species is significant for its role in re-framing biodiversity as 'off-settable'. But the conceptual technology of NNL in combination with the equally abstract schematic of the mitigation hierarchy forms a hybrid device that performatively shapes the conditions for making BDO conceivable. The concept of the mitigation hierarchy along with requirements for Environmental Impact Assessments (EIA) and Statements (EIS) emerged under Nixon in 1970 with the creation of the EPA. The mitigation hierarchy was introduced to encourage regulators, prior to the permission of approval being awarded to major development projects effecting change to the natural or man-made environment, to assess each potential impact and appropriate mitigation measure. Under the terminology of clause 1508.20 (CEQ 40CFR) of the NEPA, the mitigation hierarchy is defined as:

> (a) Avoiding the impact altogether by not taking a certain action or parts of an action.
>
> (b) Minimising impacts by limiting the degree or magnitude of the action and its implementation.
>
> (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
>
> (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
>
> (e) Compensating for the impact by replacing or providing substitute resources or environments.
>
> (Council for Environment Quality Executive Office of the President [CEQ] 2005: 28)

The ways in which the mitigation hierarchy and NNL, as conceptual technologies afford a coherent logic to biodiversity or other ecosystem service *offsets* is observable in the duel ways the mitigation hierarchy can be represented. The first, and original

NEPA mitigation hierarchy was a linear model outlining individual gateways through which regulators could assess a project's environmental impacts so as to inform decision making around permit approval (Figure 3). The second, and more recent method, now widely promoted by BBOP and used by Rio Tinto and others promoting BDO, attaches an aggregate rule of 'no net loss' to the schema (Figure 4). This hybrid model represents the mitigation hierarchy as a two-dimensional diagram with an x and y axis. Here, the vertical axis represents 'biodiversity value' as an aggregate sum and the horizontal axis represents an imaginary baseline at a moment in time prior to impacts. Much like the role of the baseline measurement under the SHP, the threshold on the x-axis acts as the 'limit' or 'cap' and conceptually performs the possibility for trade thereafter. The notion of compensation as the final step in the mitigation hierarchy is made coherent by the framing of biodiversity in flat quantitative value terms - as either positive or negative value on the y-axis. Biodiversity's biotic, contextual or temporal variegation and heterogeneity is effaced through its representation in the aggregate - as 'value'.

Figure 3 Mitigation hierarchy as a linear gateway model prior to the 'net' aggregate rule

Source: Author adapted from NEPA mitigation hierarchy 2000

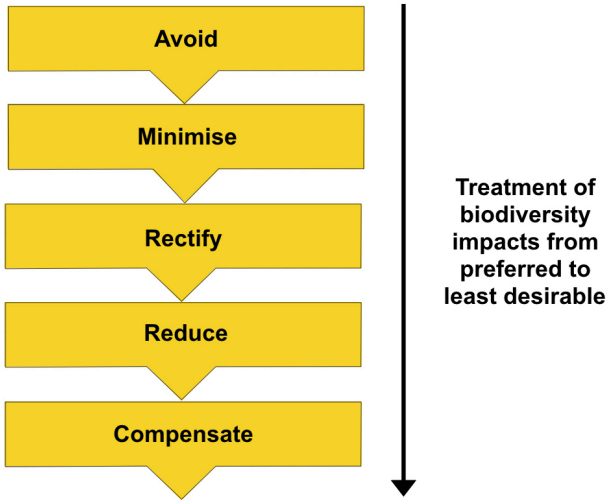
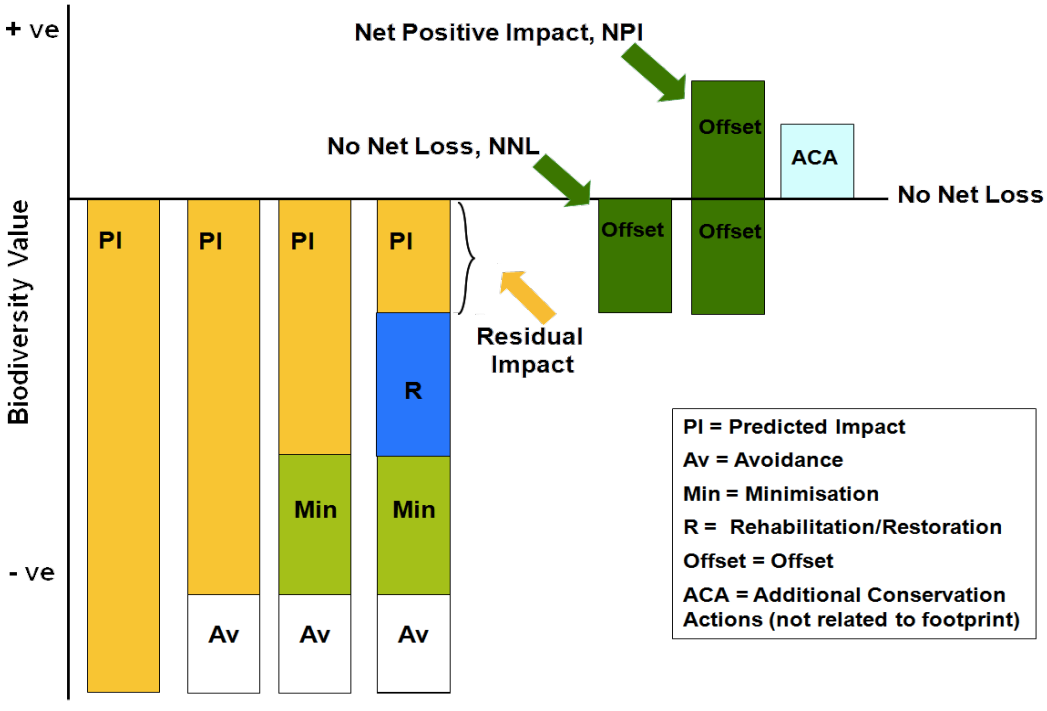


Figure 4 Mitigation hierarchy and NNL hybrid model



Source: BBOP, adapted from Rio Tinto and Govt. of Australia

I propose that it is the unique capacity of the *net* of a biodiversity baseline (x- axis) in combination with the aggregate conceptual framework represented on the y-axis that facilitates the principles of efficiency and flexibility under a market mechanism. The mitigation hierarchy's framing of 'value' on a linear scale enacts conceptual substitutability and encourages exchange of loss for gains in quantitative terms. It is consequently the 'net', which amounts to 'efficiency' so prized by business friendly environmental regulations because it enacts the conceptualisation of biotic equivalence and facilitates development but with the possibility for flexible, self-determination over the remedy. Bigger (2015), for example notes within the climate market policy of Cap and Trade, the cap is the environmental protection, the trade is simply perceived to make it cheaper. In other words, the cap is the 'end' and 'trade' is the 'means', de-coupled from one another through the 1970's bubble policy.

Wilshusen and MacDonald (2015: 16) propose that the mitigation hierarchy 'provides a framing mechanism that schematically abstracts, simplifies and homogenises biodiversity in ways that compartmentalise negative impacts and enable compensatory trade-offs'. But this is to underestimate the significance for the way the two dimensional model reduces the holistic character of biodiversity to a linear scale. This hybrid model was an innovation that emerged to introduce flexibility and latitude in conservation compliance almost three decades after the mitigation hierarchy was invented.

The conceptual potency of 'NNL' and its host, the mitigation hierarchy, are perhaps what Latour (1993) would consider archetypal immutable mobiles. NNL and the mitigation hierarchy have achieved a sticky quality through being replicated across time and space as a policy standard in conservation strategies across the world**.** Today NNL appears as a goal in biodiversity policy targets and standards at a variety of scales. This includes 27 nation states (Madsen et al. 2011) as well as a multitude of multinational corporations (Rainy et al. 2014) and financial institutions (IFC 2012). The European Union adopted a goal of NNL as Action 7 in its 2011 Biodiversity Strategy to 2020, as did the UK in its national planning policy reform and its *2011-2020 Biodiversity Strategy* (DEFRA 2011a), discussed later in this chapter. 'No net loss' has even been adopted as policy in select English local government level biodiversity strategies, and incorporated into corporate sustainability frameworks at the level of individual firms, as discussed later.

The autopoietic success of NNL is not authorless, however. Several decades separated its conceptualisation within the assemblages of US environmental policy and re-scaling in local government departments across England. Various invested market-makers were involved in efforts to institutionalise NNL outside of the regulatory contexts of US environmental policy. It is to this period in NNL's history that I now turn.

4.3 Scaling up NNL: transnational assemblages of BDO

BBOP and other market makers

In 2004, Kerry ten Kate left her role as Director of Investor Responsibility at Insight Investment, to take up the Directorship post of the newly founded Business and Biodiversity Offset Programme (BBOP). Shortly before she transferred, ten Kate co-authored with Josh Bishop at IUCN and independent consultant Ricardo Bayon[12] *Biodiversity offsets: views, experience and the business case* (ten Kate et al. 2004). The report is considered to have been biodiversity offsetting's gateway from US environmental regulation into the rest of the world (Calvet et al. 2015a). It propelled the idea into global conservation discourse, but specifically with a voluntary corporate audience in mind (Benabou 2014). Although varieties of wetland or species offsets had been developing for the previous two decades in the US, this moment was the first time the word 'biodiversity' had been attached to 'offsets' and presented for use in a voluntary transnational context. The drivers of this transition came about largely due to the increasing pressure the international mining industry was facing at the time to improve its social and environmental record (Benabou 2014). The flipside to these reputational challenges, as John Groom of Anglo American explains, were implications for access to land and markets and cost of capital (ibid: 104), meaning that there was a strong business case for attending to the environmental and social impacts of the sector's activities, rather than any crisis of conscience per se.

Pressure on the largest mining corporations mounted in the early 2000s from a range of NGOs (Benabou 2014). The industry responded through forming the International Council on Mining and Metals (ICMM), which was increasingly

[12] At the time of authoring this report Bayon was an independent consultant but later founded carbon and ecosystem service investment and trading company EKO Asset Management Partners and the Ecosystem Market Place.

engaging with the IUCN specifically in relation to residual biodiversity losses at sites of minerals extraction (ibid.). Over this period, early articulations of business and biodiversity collaborations were consolidating and ten Kate was intimately involved in promoting BDO mechanisms to business and investment audiences in the mining sector as a convenient and effective strategy to manage these reputational risks (ibid.). The 'offset mindset', as the ten Kate et al. (2004), report puts it, was gaining ground. An individual at British Petroleum (BP) communicated as much in 2003, in claiming that she expected BDO to allow the company to '*transcend the trade-offs* between the benefits of development and energy use, on the one hand, and environmental considerations, on the other' (ten Kate, Bishop and Bayon 2004: 53 emphasis added).

In 2004, Rio Tinto adopted the 'net positive impact' principle into its Biodiversity Strategy, putting itself at the forefront of this voluntary initiative (Benabou 2014). As is the case today, BDO in these early years was promoted according to its compatibility with commercial logics. In this way, it echoed the ostensibly unchallengeable neoliberal principles undergirding the 'controlled breaches' of early regulatory standards in the mid 1970s and the associated aggregate rules model of a bubble policy and NNL. The 'business case' for BDO was emphasised on account of its 'flexibility, efficiency and effectiveness' (ten Kate 2003: no page), and like NNL, BDO was framed as an 'innovation' as a means 'to think outside the box' (see Figure 5) from the very beginning. In particular, this emphasis on the business case and the novel opportunity it offered to 'transcend the trade-offs', between development and biodiversity sought to neutralise the perceived antagonism between economic growth and biodiversity conservation. This business case was key to stimulating corporate interest in voluntary capacities (Benabou 2014).

Figure 5 Biodiversity offsetting comedy- try some 'lateral thinking'

Source: ten Kate 2003

In the language of assemblages (Li 2007a), for the next 10 years BBOP worked to authorise the expert knowledges and language of BDO, forge alignments between individuals and institutions and generally condition contexts where BDO could stabilise as an idea and policy approach. It did this institutionally through prolific report writing and the building of epistemic communities through actively convening spaces for professional networking and collaboration. Over the past twelve years BBOP has published dozens of papers, technical reports and guidelines. The years of 2009 and 2012 were particularly productive, and included release of the *Biodiversity Offsetting Handbook* (BBOP 2009) and the *BBOP Standard* (BBOP 2012) as the means of encouraging the mainstreaming and adoption of BDO by institutional conservation actors around the world.

Today BBOP sees itself as central to 'coordinating an international community of practice' in offsetting amongst auditors, developers, conservation groups, communities, governments and financial institutions. It also frequently collaborates with technical experts in consultancies such as The Biodiversity Consultancy and eftec, with whom individuals from its Secretariat co-author their reports and scientific papers referred to above. Notably, the institutional and organisational networks of this field are quite small meaning that many of the same individual

promoters appear repeatedly in the context of different reports, conferences, and programs. Indeed, by positioning these papers as scientific journals, for example as the Bayon and Jenkins' 2010 article in the journal *Nature* testifies, a sense of technical and empirical legitimacy for the agenda is built.

The discourses, knowledge, programmes and collaborations that these networks constitute, worked to establish the field of 'business and biodiversity' over the early 2000s (Wilshusen and MacDonald 2015). Through novel institutional alliances the agenda filtered through into the global policy infrastructures of the CBD and strategic priorities of IUCN under the rubric of the 'green economy' more generally (MacDonald 2010). In respect to BDO more specifically, BBOP's language of NNL, dovetailing with the forthcoming iconic TEEB study, was incorporated into the Jakarta Charter in preparation for Nagoya and the Aichi targets that followed (CBD 2010).

BBOP's scope was initially directed towards catalysing uptake of BDO in voluntary corporate responsibility amongst mining and infrastructure firms, and subsequently on conservation's global governance frameworks. Though more latterly, BBOP has engaged with promoting BDO within national and sub-national legislative progammes. Indeed, when the states of Victoria and New South Wales in Australia began to develop formal biodiversity offsetting principles in 2012, it was directly due to the guidance provided by BBOP (Miller et al. 2015). Similarly, and as I document in the following section, ten Kate specifically, through advocacy and report writing played an important role in the generation of a BDO pilot study in England. Through BBOP's channels, BDO has been actively and purposefully translated into new institutional and national contexts.

Biodiversity offsetting in practice

By 2011, BDO existed as a legislative mandate in 45 countries and was under development in another 27 (Madsen et al. 2011). Despite the apparent appetite for the idea and widespread uptake in regulatory as well as voluntary contexts, Bull et al. (2013) propose that after a decade in development, biodiversity offsetting has reached a 'critical moment'. Systematic reviews of academic and grey literatures indicate that the approach was lacking clear guidance and evaluation criteria and was thus besieged with theoretical and practical challenges of implementation (ibid). These challenges include difficulties in defining ecological currencies for establishing

biodiversity equivalences in losses and gains through appropriate metrics; consensus over establishing biodiversity baselines and measuring improvements as counter-factual scenarios; compliance with design principles and enforcement; and a vast range of other ecological and political complexities (Bull et al. 2013.).

In particular, scholars have pointed towards a misplaced faith in restoration ecology science, with the multipliers designed to rectify the 'time lags' between ecological losses and gains as well as the 'uncertainty and measurability of value being offset' (Maron et al. 2012). In short many of these difficulties stem from the challenge of making different natures commensurable[13] (Robertson 2006). What's more, 'path dependent time lags', ecological non-linearity and climate change are also expected to reduce the predictabilities with which offsetting and restoration ecology can be enacted with confidence (Sullivan 2017: 230).

Walker et al. (2009) synthesise empirical reviews of BDO and show a weak evidence base for its success in delivering biodiversity gains in practice. They say that these reviews tend to blame failures on inadequate assessment currencies, disregard for exchange restrictions and poor enforcement. Some even propose that NNL is fundamentally impossible to achieve in reality due to lack of data on populations, species and ecosystems and the difficulties of collecting new data (Gardner et al. 2013). As a result, Walker et al. (2009) surmise that BDO in practice is in fact little more than a symbolic policy used by regulators with limited interest in addressing the wider causes of biodiversity loss. Yet, for the most part policy-oriented technical literatures of BDO continue to present these theoretical and practical problems as being resolvable. Improved scientific techniques and resources, the refinement of political and administrative capacities (Gardner et al. 2013) or more and better policy guidance (Pilgrim et al. 2013) are referenced as the means by which BDO can overcome its technical challenges.

To return to Li's (2007a) 'practices of assemblage', the spirit of 'refinement' that continually affirms BDO's potential typifies strategies of 'rendering technical' and 'managing failures'. The ecological and policy literatures referenced above (often authored by members of the epistemic community entangled in the BBOP

[13] The processes through which the DEFRA metric attempts to achieve ecological equivalence between habitats lost and gains is addressed later in this chapter.

assemblage discussed) do not fundamentally question the internal logic of BDO and NNL, nor their appropriateness to address the scale of challenge for reversing the decline of species and habitat loss. Instead, the papers incline towards narratives that re-affirm and reproduce the basic axioms of aggregate rules and market based instruments. This stabilisation of BDO's 'enabling assumptions' is consistent with the expectations of assemblage theory in general. In this respect, questions of agency are credited to 'situated subjects who do the work of pulling together disparate elements without attributing to them a master-mind or a totalising plan' (Li 2007a: 265). Instead, Li articulates that actors' contributions and actions are orientated around 'habit, accretion and bricolage' (ibid: 265) meaning that substantive assumptions tend to go unchallenged. Indeed, a germane question critical social scientists are now investigating, is how biodiversity offsetting has become so popular when its empirical foundations are so weak? (Benabou 2014, Calvet et al. 2014)

This chapter proposes that one answer lies in the accretion, normalisation and adoption of powerful conceptual technologies. These technologies frame aggregated sums of environmental totals permitting the idea of substitutability and exchange between kinds and types of environmental goods and bads, necessarily obfuscating any specificities or differences of the things to be exchanged. I have used the term conceptual technologies, to try and capture how it is that they can colonise thinking patterns to circumscribe certain technical (and measurable) solutions over alternatives. I wish to emphasise that this process also tends towards occluding wider debate about the systemic drivers of biodiversity loss in the first instance. It is in these ways that NNL and the mitigation hierarchy are performative of BDO and the kinds of values that it is interested in. In addition, I have proposed that the political economy of environmental regulations and conservation rendered such governance interventions compatible with capitalism. The contexts in which these conceptual technologies were conceived, deployed and continue to circulate, shape how they emerged as effective agents in making BDO 'thinkable'.

As well as a conceptual technology, NNL and BDO have also been simultaneously imbued with a moral imperative and aligned to an ethical framework for action. In particular, this ethical framework is achieved through being juxtaposed against a 'business as usual' trajectory to validate BDO as 'better than nothing'. The forming of the assemblages through which these conceptual technologies have emerged and circulated over the past 40 years serves to render BDO as a potent weapon in the

arsenal of techniques ready to present economic growth compatible with conservation policy and practice. This is the compelling logic of the 'green economy'.

But this is not to overplay the smoothness with which BDO appears or can be implemented in national legislatures. The following section moves the discussion to the emergence of BDO as a proposed pilot study in 2011 within English planning and environmental policy to illustrate how the assemblages re-scaled within this context. In this section I highlight how the social, political and ideological factors that converged to give rise to BDO in the first place were also ultimately factors that belied its ability to establish itself in any formal sense beyond the pilot studies of 2012-2014. This is a paradox that I will return to in chapter 9.

4.4 The 'greenest government ever': NNL and biodiversity offsetting in England

Articulations of the 'green economy' through a discourse of biodiversity and ecosystem valuation were strengthening at national as well as international scales in 2010 when the new UK Conservative–Liberal Democrat coalition government came to power. Later that year, at the UN CBD's 10th Conference of Parties (CoP) in Nagoya, 92 countries affirmed that the 'values of nature' should be taken into account at all levels of government. These discourses and their institutional contexts coalesced in 2011 amid a unique political moment as the new government initiated a formal pilot study into biodiversity offsetting in England. In what would later become a promise that lay in tatters following a virulent programme of austerity, de-regulation and dominant pro-growth 'economic recovery', the new British prime minister, David Cameron announced that his would be 'greenest government ever'.

In the UK, a flood of reports, white papers and studies emerged, invigorating England's biodiversity strategies to meet 2011-2020 conservation goals that the UK had signed up to under Nagoya. The Coalition Government published England's new biodiversity strategy; *Biodiversity 2020: A strategy for England's wildlife and ecosystem services*. This strategy replaced the UK Biodiversity Action Plan (UKBAP) framework that had been operational since 1994, after the UK had first ratified the CBD at the Rio Earth Summit. During this upheaval, NNL and offsetting found their way into and fixed in place within English biodiversity and planning policy inscription and into various reports at different levels of government, including *Biodiversity 2020*.

Two major studies into the state of biodiversity in England partly shaped the scientific and policy context in which BDO materialised. The previous incumbent Labour Government initiated the first: *The Lawton Review* (Lawton et al. 2010), which was an independent review of England's wildlife sites and ecological networks chaired by Professor John Lawton. The Review presented an arresting assessment of England's 'fragmented and isolated' wildlife habitats that were correlated with 50 per cent declines in well-known species. The report concluded that the state of biodiversity protection in England was found woefully lacking and resolutely failed to deliver a 'coherent and resilient ecological network'. In calling for 'more, bigger and better space for nature', Lawton advocated for a 'step change' in biodiversity policy to improve conservation outcomes in England. Within this spatially determined programme of work for efforts to restore England's ecological network, the Lawton Review recommended a system of biodiversity offsetting to be tested via pilot schemes.

One year later in 2011, Government published its National Ecosystem Assessment (UK NEA), as the first national evaluation of the state of the natural environment in terms of ecosystem services as benefits to society. The NEA (2011) hinged on economic valuation frameworks with a view to reconciling the functionality of ecosystems and habitats with social (largely economic) needs. In this way, the study was positioned to complement the ecosystem services framework of TEEB and priorities for recognising biodiversity values that emerged from Nagoya and the post 2010 conservation landscape generally (Apostolopoulou and Adams 2015). Building on both the NEA and recommendations from the Lawton Review, *Biodiversity 2020* subsequently put forward a comprehensive suite of recommendations for terrestrial and marine ecosystems and, as a priority action; to establish biodiversity offsetting pilots through a two-year test phase (DEFRA 2011a). *Biodiversity 2020* articulated Government's intentions to reform what was perceived to be a costly and overly centralised planning system to help deliver homes and business infrastructures, while simultaneously introducing the objective for a 'no net loss of biodiversity' (DEFRA 2011a: 27).

In addition to *Biodiversity 2020,* DEFRA also produced the first natural environmental white paper (NEWP) for 20 years entitled *The Natural Choice: Securing the Value of Nature* (DEFRA 2011b). The NEWP was published in June 2011 to build on the findings of the NEA, which was released in the same month and invoked

a strong discursive commitment to the economistic rationales for building the 'green economy'. Along with announcements for a two-year biodiversity offsetting pilot study to get underway in 2012, the NEWP presented a range of other neoliberal initiatives for market and business led conservation practices that would further deepen and institutionalise ecosystem valuation and market based conservation. This included the formation of the Natural Capital Committee (NCC), a Government body set up to report directly to the Treasury with a remit to 'put natural capital at the centre of economic thinking and at the heart of the way we measure economic progress' (DEFRA 2011b: 4). Lifting from the World Bank's Wealth Accounting and the Valuation of Ecosystem Services (WAVES) approach, the NCC was formed to produce a set of 'green accounts for UK Plc. 'showing where our economy has withdrawn from nature's bank balance' (DEFRA 2011e). Other initiatives included the creation of an Ecosystems Market Task Force (EMTF) to expand UK business opportunities for a trade in green goods and environmental services (DEFRA 2011b).

Government released its *Biodiversity Offsetting Green Paper* in September 2013, as part of a customary consultation process to solicit feedback from inside and outside of Government over proposed policies and legislation. Unease about the potential burdens and additional costs BDO could present for developers is one of the reasons why DEFRA only recommended a permissive rather than a mandatory regulatory system of BDO in the Green Paper (Duke and ten Kate 2014). The Green Paper noted:

> Government will only introduce an offsetting system if it is satisfied it will …avoid additional costs to businesses. This will ensure it is consistent with Government's commitments: not to increase net burdens on housing developers over the Spending Review 2010 period; and to one-in, two-out on all regulatory burdens (DEFRA 2013: 8)

Perhaps September 2013 was a strange time for Government to hold a Green Paper consultation, seven months before the 2012-2014 pilot studies had even been completed. Director of Conservation at the RSPB Martin Harper suggested that one reason might have been the desire to 'assess the evidence base for the potential cost savings before the December regulatory review' (Harper 2014, no page). Harper was referencing DEFRA's *Smarter Environmental Regulatory Review* that was underway between July 2012 and March 2014, through which DEFRA would need to report to the Treasury and demonstrate that their policies were consistent with Government's

de-regulation agenda (further discussed below). The premature timing therefore of the Green Paper indicates how BDO was primarily being assessed in terms of its economic implications rather than waiting to see what the ecological and conversation outcomes of the pilot might show.

Certainly, the Green Paper invoked a dominant discursive orientation to appeasing the development lobby through emphasising that BDO would make planning 'quicker, cheaper and easier for developers' (DEFRA 2013) and the 'business case' for the policy more generally. Putting forward an idealistic narrative of 'something for everyone' the Green Paper described a catalogue of overlapping 'wins' available from BDO. A series of counter claims emerged from concerned academics, NGOs, ecologists and civil society disputing the simplistic advantages BDO was promised to deliver (Sullivan and Hannis 2015). Many of these concerns noted the incongruence between DEFRA's emphasis on biodiversity goals and the wider political context of 'economic growth at any cost' (Harper 2014 pers. comm) in which BDO was being introduced. Among other complaints that made up a sizable body of critical responses to the Green Paper and subsequent Environmental Audit Committee Enquiries (see Sullivan and Hannis 2015 and chapter 8), one emphasised that far greater gains could be achieved for biodiversity in the planning system through strengthening planning officials' authority and capacity for meeting their existing biodiversity duties under the National Environment and Rural Communities Act (NERC) (Friends of the Earth 2014). Very few LPA ecologists have a working knowledge or capacity to enforce the mitigation hierarchy framework (Oxford 2013) and in house ecology teams remained scattered and poorly resourced (Friends of the Earth 2014, NGO1-TLP Jan 2016, NGO01 Jan 2016).

Although BDO was actually realised under the coalition government's wave of strategic biodiversity and planning reforms, it was not conceived by them. Prior to 2010, DEFRA, under the Labour Government, had already commissioned and published a scoping study for the possibility of using biodiversity offsets. Released in 2009, the extensive scoping report led by independent consultant ecologist Jo Treweek presents the intellectual roots of BDO originating from the distinction between strong and weak sustainability principles outlined by Pearce and Atkinson (1995) (Treweek et al. 2009). Premised upon biological analogies to capital, the report capitulates to economic logics and states that:

> biodiversity is increasingly seen as a form of capital that contributes to a country's welfare via the production of ecosystem goods and services. Using a capital analogy, the depletion of natural assets or in this case species and their habitat can be likened to a form of depreciation to a capital stock. (Treweek et al. 2009: 11)

Taken to be axiomatic to the study, Treweek et al. juxtapose environmental economic theories with the Government's development aspirations articulated through its 2007 Housing Green Paper for the delivery of 3 million new homes before 2020. The report's authors therefore recommend mechanisms that can meet biodiversity commitments 'in conjunction with housing growth and delivery of associated infrastructure…' (Treweek et al. 2009: 9). The recommendations from the scoping report arrive at a system of biodiversity offsets and reference inspiration from international examples such as the US wetland compensatory mitigation since the 1970s, and active, 'well established' BDO schemes at federal and state levels in Australia. The DEFRA 2013 Green Paper draws on these precedents as demonstration projects and thus validation for BDO, and in so doing glosses over the weak empirical evidence for their success mentioned above. Through an in depth case study of the Network Rail BDO arrangements, chapter 7 illustrates how the construction of evidence to use as legitimation case studies is a circular process. Much of this scoping report was subsequently recycled into the technical guidance over the use of the DEFRA metric in determining the 'currency' within BDO (Treweek et al. 2010), which I discuss in the following section.

Revolving doors

Despite the strengthening of ecosystem valuation discourses prior to the election and the commissioning of a 2009 scoping report, BDO had so far only garnered a vague interest from central government. Yet David Hill, founder and director of private environmental service brokering firm, *The Environment Bank,* had been actively lobbying for the introduction of BDO and habitat banking systems since 2007. The Environment Bank had positioned itself as a broker seeking 20 per cent of the compensation fee for every offset that it enabled (OB1-WCS 300714). Luckily for the Environment Bank, things were starting to move in the run up to the 2010 election. By Hill's own admission, when 2009 came around and the shadow Conservative

cabinet were actively 'looking for new ideas', he found that he was suddenly 'pushing at an open door' (Kenny no date).

An un-qualified programme of 'conservation credits' thus appeared in the Conservative Manifesto 2010, along with assurances for a Natural Environment White Paper after the election. Offsetting shot up the political agenda for biodiversity along with other economistic or natural capital approaches in the early years of the Coalition Government. Biodiversity offsetting started to appear as a number one priority in a number of key policy documents. Notably, a small coterie of individuals, already with a direct interest in offsetting authored many of these documents. In a similar way to the transnational scale, it was the role of key visionary individuals that shaped the strengthening of the business and biodiversity alignments in England (MacDonald and Corson 2012, Benabou 2014, Wilshusen and MacDonald 2015). Indeed, some of these individuals like Kerry ten Kate demonstrably transversed tiers of international governance and directly contributed towards BDO's adoption in England. David Hill for example, also became a central figure in the expert assemblages shaping knowledge around business and biodiversity in the UK from 2010 onwards. Hill made up one of ten members of the Prime Minister's newly appointed Ecosystem Markets Taskforce (EMTF) announced through the NEWP. In its final report in March 2013 (while the pilots were still underway) the EMTF recommended as the number one priority out of 22 key opportunities a 'mandatory programme of biodiversity offsetting' within local government planning policy (Ecosystems Market Taskforce 2013).

In addition, Hill navigated varied institutional contexts wearing different caps while promoting the need for a mandatory system of offsets. For example, for the eight years between 2007 and 2015, except one year in 2006, Hill held the twin appointments of Chair and co-founder for The Environment Bank as well as deputy chair of Natural England. As the government's statutory environment advisory service, Natural England was thus the consultative authority to local planning departments over the applicability of biodiversity offsetting. This apparent professional conflict of interest was reiterated by the permanent secondment of two Environment Bank programme officers (offset brokers) directly into the Essex and Warwickshire local government planning departments embarking on the DEFRA pilot study.

A senior ecologist at Natural England summarised the situation succinctly and is therefore worth quoting at length.

> The main push at the moment from the Defra point of view is that the Minister has a big interest in this. You know it's a key policy, but if something else where to come along that was more important then our interests would wain probably. Therefore, having an organisation out there that is driving and keeping this going and lobbying and so on… And you know David Hill has done some great work lobbying. He can get to talk to people and he has moved this discussion forward and I don't think we should in anyway, ignore the fact that offsets are where they are at the moment because of the work David has done with lobbying and talking to people around it. (NE01 150613)

The Environment Bank's influence extended further into government science-policy assemblages through other notable positions held by its directors resulting in a flurry of recommendations for biodiversity offsetting as among Government's top conservation priorities. For example, Tom Tew, Chief Executive and shareholding director of The Environment Bank Ltd, was one of fourteen panel members that made up the Lawton Review, which had recommended BDO as the primary priority for restoring England's ecological network. Meanwhile, Guy Duke, who since 2010 has held the position of Director for Europe and Research at The Environment Bank Ltd, led the research initiative that the EMT had commissioned the Valuation of Nature Network (VNN) to undertake. The purpose of the commission was to inform key priorities for biodiversity and business programmes in 2012. The results of this research again positioned BDO as first. Kerry ten Kate was among the team of eight team members that constituted this VNN research initiative. The environmental economist, Ian Dickie of eftec was another participant with whom ten Kate had also co-authored (amongst others) a few years earlier, a technical report on habitat banking for the European Commission Director General of Environment (eftec, IEEP et al. 2010).

Together, Duke and ten Kate were latterly commissioned by DEFRA in 2013 to gather evidence from a range of offset schemes in the US and Australia to advise the Department *specifically* on the economic implications associated with introducing a new regulatory framework of BDO (Duke and ten Kate 2014). The emphasis of this

study was squarely on the economic costs and benefits of offsetting systems (rather than biodiversity concerns). The governing rationale of this was to assess economic impacts on developers and house builders, to whom the Coalition Government in its Conservative Manifesto had promised in no ambiguous terms, a thorough going programme of de-regulation.

Entanglements between, and influence from, situated and charismatic individuals were not limited to independent consultants or policy entrepreneurs. An equally distinctive coalition of market oriented policy NGOs and governmental actors were steering strongly towards a system of offsetting. In addition to the enthusiastic support BDO was receiving from the actors and reports detailed above, it also found an animated advocate in DEFRA's Secretary of State Owen Paterson (c.f. DEFRA 2013). Paterson vigorously endorsed the approach in a speech to the right wing think tank Policy Exchange in November 2013. Paterson noted:

> It's incredibly apt that I'm speaking here at Policy Exchange, the think tank that through its Nurturing Nature report has put offsetting on the political agenda and highlighted the real contribution it could make to our natural environment. (Paterson 2013)

Policy Exchange's report *Nurturing Nature* (Newey et al. 2012) was released in 2012 and with an emphasis on efficiency and market discipline throughout recommended as a priority, as with the other reports previously mentioned, a mandatory programme of offsetting. A month after his speech to Policy Exchange, Paterson duly appointed its treasurer - a prolific house developer, investment banker and also Conservative Party donor, Andrew Sells, as chairman for Natural England (Monbiot 2013). The neoliberal, organisational, professional and ideological ties formatting the policy arena for BDO in England from 2010 were therefore unequivocal.

Convergence of neoliberal political imperatives shaping the context of English biodiversity offsetting

Following through on its manifesto promise to reform and unblock the planning system that was perceived to act as a 'barrier to growth and wealth creation', the coalition Government (Department of Communities and Local Government, DCLG), under the guise of its 'localism' agenda at this time also initiated the National Planning Policy Framework (NPPF). The DCLG released a draft NPPF in July 2011 and

the final version in March 2012 (DCLG 2012). The objective of the NPPF was to simplify thousands of pages of planning guidance to just 25 different Planning Policy Statements (Newey et al. 2012). Through re-drafts to specific language and concepts, the NPPF laid the policy scaffolding for BDO by incorporating the conceptual technologies inherited from US environmental policy histories I described earlier in this chapter. The mitigation hierarchy was emphasised through strengthening compensation as a 'last resort' and – most importantly - the language of a biodiversity 'no net loss' (NNL) and 'net gain' (NG) (DCLG 2012: 3) appeared for the first time in English planning guidance. Although other types of ecological compensation in English planning existed prior to BDO, this represented a dramatic shift since it proposed that gains must measurable, denoted through metrics and proxy scores and sustained over time (DEFRA 2013). NNL and NG replaced the prior Planning Policy Statement 9 (PPS9) Biodiversity and Geological Conservation policy that until this point required development to have 'minimal impacts' and enhancements 'wherever possible'.

The NPPF also included the pervasive ideological re-formulation in which a 'presumption in favour of sustainable development' became the golden thread running through planning. Noted for its resemblance to the Thatcher era White Paper 'Lifting the Burden', the 'presumption in favour of sustainable development' reinforced the message that planning should become focussed upon delivering, not restraining development (Hannis and Sullivan 2012). This emphasis chimed with the political priorities of the moment, in seeking to streamline and de-regulate planning restrictions to get Britain building, and squared the circle with the largely economic based justifications for BDO in the 2013 Green Paper and the 'green' growth outlined in the NEWP.

Neoliberal technologies; austerity and de-regulation

Layered over these various factors, a deepening project of austerity further underscored a glaring mismatch between the energised rhetoric of the 'greenest government ever' and the fiscal retreat in the opposite direction. In the post-GFC era of austerity programmes, Government spending cuts spelled reductions to all government departments except initially for the Dept. of Defence, the Dept. for International Development and the National Health Service. DEFRA lost 29 per cent of its budget over the course of the coalition government from 2010-2015 (HM

Treasury 2010). By the end of 2019, overall planned cuts for DEFRA are estimated to be 57 per cent in real terms with 5000 estimated redundancies from the Department (Howard 2015). Dramatic spending reductions for local government also saw the shrinking of ecological teams and the capacity of local planning authorities in general (Oxford 2013). These cuts to LPA ecological capacity came on top of what was already a somewhat enfeebled subdivision of local government. Policy Exchange (Newey et al. 2012) supports analysis that only 35 per cent of local authorities even had an in-house ecologist in 2012, reinforcing the incongruity between aspirations and ambitions set out in the NEWP and the diminishing availability of LPA's ability to meet them. One of the authors of DEFRA's official evaluation of the pilot proposed that in terms of conservation spending, disproportionate gains could be made from directing what funds had been made available after the NEWP to local government ecologists to help them enforce the LPA's biodiversity duties. My interviewee stated:

> I was part of the monitoring and evaluation team of the Nature Improvement Areas and they had £12m and did a lot of great stuff, but…you know what's the counter factual for £12m? You can buy a lot of ecologists and you would probably get a lot better biodiversity outcomes if you had county ecologists in these areas (NGO01 280116).

It was within this political climate, that the Royal Society for the Protection of Birds (RSPB) in their 2010 report *Financing Nature in the Age of Austerity* declared BDO to be the 'top priority' for new innovative sources of funding (Comerford et al. 2010)[14]. The growing alignment, furthermore, between a stabilising neoliberal consensus over ecosystem valuation and markets to stimulate innovate sources of funding for conservation in the dual age of austerity and the 'green economy' dovetailed with an economic 'recovery' agenda characterised by deregulation. The Coalition Government, upon coming to power in 2010 introduced a programme of de-regulation for business known as the 'one in, two out rule' (UK Dept. Business, Innovation and Skills 2010) as the first rule of its kind to seemingly provide an overall 'net loss' in regulation. In 2015, this policy was stepped up to a one in, *three* out rule expected to 'cut a further ten billion pounds of red tape' (Dept. Business Innovation

[14] Others sources of funding included environmental taxes, NGO sector funding, and private payment for ecosystem services (PES) schemes.

and Skills et al. 2015). The Cabinet office maintains a website called *Cutting Red Tape* emblazoned with a logo illustration of red tape being cut by scissors to emphasise the point[15].

The DEFRA pilot evaluation report was expected to emerge by the summer of 2014 following the conclusion of the two year study period. As discussed in the introductory chapter to this thesis, DEFRA, together with BBOP and the ZSL, hosted the first global summit of its kind, *To No Net Loss of Biodiversity and Beyond,* in June of that year, which was expected to coincide with the evaluation results. And yet, following Owen Paterson's conspicuous absence from the conference despite his scheduled plenary address, the understanding was that, following the fulcrum of the Green Paper, and the apparent unfavourable results from the pilot study showing that at all levels BDO would cost more not less, the political context for BDO had changed (ten Kate pers comm). In summary, despite the apparent thrust and political appetite for BDO articulated through the flurry of reports that I traced in the opening of this section, the wider political economy under which BDO was initiated ultimately prioritised de-regulation over meaningful shifts in conservation policy. As one of my interlocutors, who had been closely involved in putting together the evaluation report, described:

> The main reason why offsetting isn't going to happen and we are not going to have mandatory system and why DEFRA haven't said anything for a while, and the reason why my organisation see offsetting as a medium term thing that we have to approach very obliquely, indirectly and discretely - is that HMRC and DCLG don't want it. The reason they don't want it is because of what the evaluation of the pilot said very explicitly, which is when you use the metric and you see the harm people are doing, you realise that the vast majority of applications are resulting a net loss of biodiversity. But the vast majority of them, and I really do mean the vast majority of them aren't doing any kind of on or offsite compensation. We're just no-where near to being able to get a net gain. (NGO01 280116)

[15] https://cutting-red-tape.cabinetoffice.gov.uk/ (Accessed February 10th 2017)

The economic as well as the political costs of imposing biodiversity compensation to reverse this trend were simply not tenable for the Coalition Government, and certainly not months before a general election in 2015. Following the election, the new, and wholly Conservative Government allowed BDO to quietly fade out of sight and mind and the policy cycle to move on. Nevertheless BDO continued, and indeed arguably accelerated, with recourse only to the NNL policy contained within the NPPF and the calculative technology - the DEFRA metric - available for use by motivated planners diligently pursuing this policy. It is towards the DEFRA metric that the discussion now turns.

4.5 An iconic calculative device: the DEFRA metric

In 2012, DEFRA introduced its now iconic (Sullivan 2013b) metric as a calculative device for constructing a 'value' for biodiversity as a numerical surrogate. The metric is the principal calculative device poised to shift ecological impact related decision making processes to a quantitative methodology under the offsetting pilot. As iterated in chapter 2, calculative devices undertake 'processes of classification, clustering and sorting that makes products both comparable and different' (Callon and Muniesa 2005: 14). The promise of the metric, therefore lay in its capacity to measure and numerically account for each step of the mitigation hierarchy and determine any resultant compensation required through biodiversity offsets. This 'measurability' permits comparisons using a common metric between losses with gains made elsewhere with a view to achieving the calculations of a 'no net loss' of biodiversity. In this respect, the metric's main power lay in its ability to engineer commensurability between biotic assemblages at sites of impact with those proposed to be created at offset sites. In other words, the metric acts to 'make things the same' (MacKenzie 2009).

The DEFRA metric (shown in Table 6) was developed by Natural England in consultation with a range of external consultants and advisors (see also Treweek et al. 2009, 2010). As the basis for the BDO 'currency' of biodiversity 'units', the metric combines ecological value with a spatial area. This combined approach was adapted from the habitat hectares (Parkes et al. 2003) methodology employed in BioBanking and Bushbroker systems of offsetting in Australia and legitimated and popularised through its incorporation into the BBOP 2009 *Handbook* (see above). The methodology was nevertheless modified to offer a bespoke fit with the conservation

policy frameworks and biological and habitat assemblages of England drawing heavily from the scoping study provided by Treweek at al. 2009, 2010 (DEFRA 2011d), discussed above. 'Habitat-hectares' is a compound metric (Bull et al. 2013) approach to include spatial area (hectares) against two other ecological indicators across habitat condition and distinctiveness. The combination of these three values produces a matrix against which a single unit score as surrogate can be produced. Land area is an integral component of biodiversity value made through habitat hectares. Treweek et al. (2009) propose that spatial metrics are essential for a comparative purposes of biodiversity losses and gains where land-use change is concerned. As its name suggests, habitat hectares therefore formed an entirely new ecological indicator in England as a 'scientific' unit with spatial values embedded within it. As will become clear in the discussion below, the spatial component of these units is partly what enables practices of commensuration under offsetting.

Table 6 The DEFRA biodiversity metric (matrix)

Matrix showing distinctiveness and condition		Habitat Distinctiveness		
		Low (2)	Medium (4)	High (6)
Habitat Condition	Good (3)	6	12	18
	Moderate (2)	4	8	12
	Poor (1)	2	4	6

Source: Author adapted from DEFRA 2011c

The advantages of using habitats as an indicator and basis for developing the currency of 'biodiversity units' is that this biotic scale can accommodate species populations as a secondary indicator (Treweek et al. 2009). The application of the habitat as the conservation unit of interest reflects what is elsewhere referred to as a 'coarse filter', rather than 'fine filter' that would pick up individual species populations (Kiesecker et al. 2009) (echoing the etymology of the word 'net' that opened this chapter). As its architect explained, 'habitat hectares' aims to provide an integrated view of the habitat for all the indigenous species that may reasonably be

expected to use a site, but not its suitability for a single species (Parkes et al. 2003), unlike species banking (Pawliczek and Sullivan 2011). As such, Treweek et al. (2009) explains it is favoured for 'lending itself to the concept of aggregating offsets at sub-regional level' and for being able to be applied to develop offsets as a mechanism for delivery of national and local Biodiversity Action Plans (BAPs), which are habitat based. It is further justified on the grounds that when 'compared with species populations, habitats are relatively stable over time, can be adequately described with fewer types and are normally used as the primary focus of biodiversity conservation' (Treweek et al. 2010: 29). I explore the experience of this feature of the metric and the implications for the tensions it produces between habitat and species conservation policies in chapter 6.

To use the metric, as a first step, development and offset sites must be spatially mapped to produce habitat parcels. These parcels are then assessed according to the three attributes (values) that make up the habitat hectare calculations; spatial area, habitat distinctiveness and condition. DEFRA provides a gridded matrix for these attributes so as to allocate one of three banded scores for different indicator grades in distinctiveness and condition. Distinctiveness grading follows habitat types allocated to bands of priority habitats defined against the benchmark of 'naturalness' under Section 41 of Natural Environmental Rural Communities (NERC) Act 2006[16]. Parameters include species richness, diversity, rarity (at local, regional, national and international scales) and the degree to which a habitat supports species rarely found in other habitats (Treweek et al. 2010, DEFRA 2011d,). 'High' habitat band

[16] The metric was designed to be compatible with how biodiversity targets are articulated in the UK Biodiversity Action Plan (UKBAP). Given that the system of offsetting is intended to provide a means for securing compensation in impact areas falling outside of the EU Habitats Regulations designated Natura 2000 sites, and most of these fall within BAP designations the metric speaks directly to this framework (Treweek et al. 2009). However as already mentioned, the UKBAP was succeeded by new the Biodiversity Framework published in July 2012 according to new international priorities defined by the CBD Aichi Targets, to be carried out at devolved country level. The UKBAP statutory lists of priority species and habitats however, formed the basis for those that are protected under each separate country. England's legislation is set out in the Natural Environment and Rural Communities (NERC) Act 2006. http://jncc.defra.gov.uk/page-5705 (Accessed March 29th 2017).

distinctiveness relates to priority habitats as defined under the NERC Act[17]; medium distinctiveness relates to 'semi-natural' habitat; and low distinctiveness conveys a landscape made through intensive management such as high input agriculture or intensive grazing. Scores of 6, 4 and 2 designate these bands respectively. DEFRA provided a list of common habitats pre-allocated to distinctiveness bands in Appendix 1 to the metric's technical paper (DEFRA 2011d).

The habitat condition grades are adapted from the Higher Level agri-environment Scheme (HLS) Farm Environment Plan Manual (FEP). DEFRA selected this as an alternative methodology to the more commonly known system provided in the Common Standards Monitoring (CSM) used for assessment of Sites of Special Scientific Interest (SSSIs). This CSM methodology is designed to give a specific output that categorises sites into three states namely 'favourable', 'favourable recovering', and 'unfavourable' (DEFRA 2011d). DEFRA claim the FEP condition assessment tool 'better meets the design criteria for our approach to offsetting' since it 'is based on habitat condition, rather than management, and the categories are spread evenly in a way that fits with the design of the offsetting metric' (ibid.: 6). DEFRA propose that the FEP manual offers 'clear and transparent methods which divides condition into one of three categories', across good, moderate, poor with scores as 3, 2, 1 respectively.

A range of tensions sit at the heart of the DEFRA metric. Such tensions originate from its need to be many things to many people and thereby strike a balance between ease of use, scientific precision as well as delivering economic efficiency. For example, the official BDO scoping report by Treweek et al. (2009: 118) recognises that 'a larger matrix might give a closer fit to reality but would be less straightforward to apply in practice'.

Calculating risks through exchange rules and multipliers

DEFRA's exchange rules determine that offsets for the most part do not have to deliver a 'like for like' trade for exactly the same habitat 'types' or sizes of impact in spatial terms (DEFRA 2011d). However, they do require that restoration or expansion

[17]http://webarchive.nationalarchives.gov.uk/20140711133551/http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx last (Accessed 29th March 2017)

should only target habitats in the medium and high distinctiveness categories. Offsets should never down-trade from a higher distinctiveness band to compensation provision in a lower one (ibid.).

Inherent in any offset conservation and restoration works are myriad risks and uncertainties; these are associated with;

1) delivery risks, such as the difficulty of creating habitat,

2) spatial risks relating to the geographical distance between loss and the new strategic placement of the offset affecting the integrity of regional ecological distribution and networks,

3) and temporal risks associated with the time to target condition and any possible time lag between impact and offset.

The DEFRA offset model attempts to account for these risks numerically with multipliers that augment and enlarge the offset credit provision requirements (and the subsequent price to the developer through compensation). Delivery risks relate to the uncertainty around the effectiveness of the restoration and reflect that some habitats will be more difficult than others to 'deliver' as an offset. The delivery risk multipliers can enfold separate values from quantity (number of hectares) with quality (habitat type or condition) by requiring that a 'difficulty' multiplier score be awarded. This score is seen to act as insurance against the possibility of the restoration or expansion efforts not working.

Much like the distinctiveness and condition scores, the difficulty multipliers are banded into different categories of low, medium and high and very high with values of 1, 1.5 and 3 and 10 respectively. For example, a broadleaf woodland plantation that is deemed to be of medium difficulty to create is thus awarded a score of 1.5. Putting aside the time it would take to reach target condition and maturity (of more than 32 years), this principle operates by assuming that in creating an extra 50 per cent of woodland in spatial terms (through a 1.5 multiplier), even if one third of the total offset provision failed, over the 32 years expected to target condition there would be 'no net loss' of biodiversity as the extra 'units' provide an 'insurance' mechanism. Multipliers increase the number of units necessary for compensation and in so doing they actually divide the unit value previously available for spatial areas. Chapter 7 provides empirical examples for how this works in practice.

Despite this apparent technical reassurance, DEFRA (2012a) reference a BBOP consultation paper by Biodiversity Consultancy director, John Ekstrom, which argues that exchange multipliers typically have not worked well. Ecological science has shown that where they are used they need to be very high (Moilanen et al. 2009), and often much higher than is considered palatable for business actors. So as to arrive at a workable system in England, DEFRA chose to overlook this evidence and adjusted the multipliers into levels that they claim are 'practical' and 'reasonable' for developers (DEFRA 2011d).

Since BDO is proposed to act as a spatial rationalisation and consolidation of England's ecological network (Lawton et al. 2010), a central design principle is that offsets be strategically placed according to local biodiversity priorities. DEFRA guidance for regulators seeks to ensure that the delivery of offset habitat is located in a place not 'less favourable' than the development site (DEFRA 2012a). To account for these risks, this time 'spatial multipliers' reduce the value of biodiversity units that are delivered in less favourable areas (I illustrate and discuss the ways this works in practice in chapter 5). Local biodiversity spatial frameworks are therefore necessary so as to overlay maps onto strategic organisation of biodiversity losses and gains and use these to determine the values of impacts and offsets. Spatial multipliers fall across three bands with scores of 1, 2, 3. The score of 1 makes no change to the units available since it would indicate the offset is to be located in an optimal strategic biodiversity location.

Time lags are the final risk category that the metric tries to account for. Habitat banks (Briggs et al. 2009, Bekessy et al. 2010, DEFRA 2011d) that provide 'off the shelf' biodiversity units, are deemed to be able to overcome these temporal risks by eliminating the gaps in time between impact and gain. In cases where the creation of habitat banks are not possible (as in the case of the two year DEFRA pilot study) time lags also require multiplier scoring practices so as to mitigate for risks around compromising biodiversity values into the future. Rather than an ecological basis for multipliers in the case of difficulty and spatial risks mechanisms above, time lag multipliers were adapted from economic principles of discount rates. DEFRA propose that the discount rate is 'used to compare costs and benefits that occur in different time periods based around the principle that, generally people 'prefer to receive goods and services now rather than later' (DEFRA 2011d: 11).

While DEFRA recognise that this is, somewhat counter-intuitively a fundamentally anthropocentric principle and the 'ecological basis for it is more complex', they nonetheless revert to the economic standard through using the Treasury Green Book methodology of a 3.5 per cent discount rate. The Treasury says the 3.5 per cent discount rate 'reflects the value society attaches to 'consumption' (i.e. enjoyment of goods and services) at different points of time'. Using five year increments of time to determine the bands for a multiplier score derived from a 3.5 per cent discount rate, DEFRA put forward 7 possible scores for time lag risks starting at five years and ending at 32 years. Planning officials or ecologists engaged in the process are required to 'estimate time it will take a habitat to reach the pre-agreed target quality' (DEFRA 2011d: 13).

Throughout this engagement with the DEFRA metric, I have been highlighting some of the tensions associated with striking an appropriate balance between market and environmental logics. DEFRA (2011d) alludes to these tensions while describing their thinking for hedgerows in the technical guidance document. They outline the balance of values this mechanism must incorporate in stating:

> It is necessary to come up with a mechanism to account for hedgerows in our system of offsetting that both recognises their unique contribution to biodiversity whilst at the same time meeting our guiding principle for simplicity. (DEFRA 2011d: 35)

Much like 'species', the metric does not 'see' hedgerows, but on account of their very high biodiversity value and of being a feature 'almost unique to the UK' hedgerows are treated separately under their own mechanism (DEFRA 2011d). Much like the general DEFRA metric, the hedgerow valuation mechanism awards simple grades of condition according to linear spatial (metres) multipliers.

I examine the ways in which the metric is deployed in situ across my three studies where these practices of commensuration are brought to life. In so doing I illuminate the strategies actors employ so as to manage these tensions in practice, and expand a discussion around the layers of commensuration that occur through it. Of central importance here are the ambitions for the calculative technology in the metric to defuse perceived incompatibilities between economic and ecological rationales. While BDO as an instrument promises to deliver on this aspiration, the metric at a micro level seeks to achieve this through providing what Latour (2013) would label as

a ‘crossing’ between divergent ‘modes’. I propose these ‘modes’ - or orders of value (Boltanski and Thévenot 2006) translate into the distinct but compatible representational abstractions of economic and ecological data. Morgan Robertson (2006) captures this dynamic in the oft-quoted observation that offsetting metrics such create a ‘nature that capital can see’.

4.6 Conclusion and summary

This chapter has traced the origins and journey of prominent elements constituting the BDO assemblage through a historical lens. Figure 6 summarises some of the key moments of this process. The chapter opened with the appearance of aggregate rules in US environmental policy and concluded with the deployment of NNL and BDO in English planning processes 40 years later. I have attempted to illuminate the mesh like nature - or lattice work of elements that have facilitated this translation of NNL across time and space. Such elements include a variety of institutional alignments between business, economic theory and biodiversity conservation; persuasive discourses enacted through influential individuals; the stabilisation of dominant imaginaries (particular quantitative framings biodiversity and associated ethical frameworks); and the specific convergences in ideological and political circumstances in which such ethical frameworks appear coherent and convenient.

Throughout this chapter, I have highlighted the immutable character of the conceptual schema of a NNL of biodiversity and the mitigation hierarchy. No net loss acquired a potency and essence that has enabled it to ‘translate without corruption’ (Latour 1986: 8). In addition to its material consequences for biodiversity habitats, NNL also consolidates a popular imaginary of biodiversity’s ‘state based ontology’ (Maier 2012) that I discussed in chapter 2. NNL serves to ‘recursively amplify’ (Sullivan 2017) a logic that ten Kate et al. (2004) express as the ‘offset mindset’, but elsewhere is labelled the ‘offset ideology’ (Seagle 2012). Immutable mobiles refer to the circulation and agency of inscriptions across time and space. Through the account of its history, I have shown how NNL is the means through which such inscriptions can appear. NNL is the theoretical scaffolding that in its very nature requires a material calculative device such as the DEFRA metric, into which biodiversity, as data, as universal equivalents, may be inscribed. This device, in turn offers a grid into which actors quantitatively process biodiversity data with the view to securing (net) positive outcomes in the end. ‘No Net Loss’ of biodiversity is

generally seen as a good thing. It is an increasingly popular idealised standard that conservationists now tend to invoke as the goal of conservation generally. Yet, as a policy standard, NNL is *the* defining feature of balance sheet logic within environmental value making in biodiversity conservation. It is in this way that Robertson (2012: 386) suggests that NNL and the technologies of measurement it precipitates, permits planners to 'arrive at ecosystems already encountered in commodity form'. 'No net loss' frames and performs exchange values of biodiversity. It is emphatically not, therefore, a trivial or neutral development.

I described how NNL was actively promoted by various influential actors and in particular through BBOP and how the idea consequently gained traction in extractive industry sector voluntary contexts in the early 2000s. In so far as BBOP and its founders enabled and actively promoted these translations to new institutional contexts, I identify these actors to be market makers, embroiled in processes of enrolment and marketisation (Çalışkan and Callon 2010). A notable strategy in this process was the telling of powerful stories (largely dependent on the ethical potency of NNL) to neutralise perceived antagonisms between business and environment logics - 'to transcend trade-offs' as ten Kate et al. (2004) put it.

The Oxford English Dictionary (2017c) defines the word transcend, 'to pass over or go beyond'. Thus, BDO was framed as something able to make tractable that which was previously intractable - to forge a new space of congruence and harmony between economic growth and ecological flourishing. For all of its promises to be able to deliver such settlements, more than a decade in, a steadily growing number of accounts of BDO's practical implementation belie that such resolutions are possible. Indeed, while writing this very chapter, the Nature Conservation Council (NCC) of New South Wales (NSW) (2016) in Australia published findings pertaining to assessments of a decade of offsetting in the state. The summary conclusions showed empirical evidence of BDO's biodiversity outcomes to range from 'disastrous', 'poor', and very occasionally 'adequate' (NCC NSW 2016). *None* of the outcomes were deemed to be 'good'. Biodiversity offsetting, the authors concluded, was 'adding extinction pressures to the very species and communities it was designed to protect' (NCC NSW 2016: 31).

Business' adoption of NNL emerged as a strategy to incorporate external critique through inverting a primarily defensive position into an offensive one and advancing

BDO as a practical, pragmatic strategy (Benabou 2014). Indeed, this putatively political strategy of 'disciplining dissent' is a recognisable feature of the related shifts associated with the neoliberalisation of conservation more generally (Büscher et al. 2012). Through offsetting, the extractive sector was able to capture and re-frame environmental discourses in their favour (Nyberg and White 2013). The objective was to maintain the possibility for flexibly attuned, but voluntarily enacted solutions that ultimately enabled the trade or displacement of the problem.

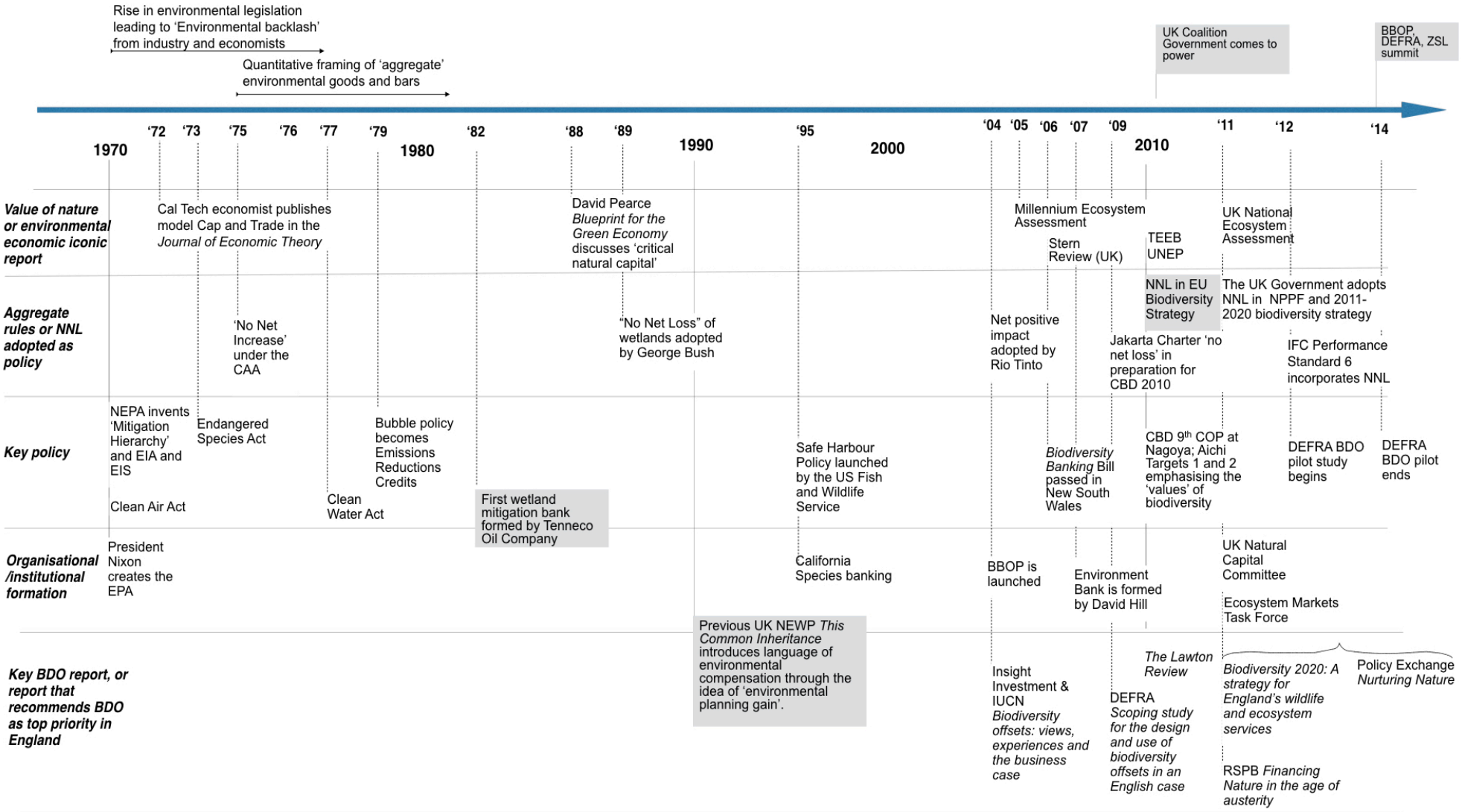
Part of this re-framing exercise draws upon narratives of pragmatism. Strongly foretelling the overriding justification discourse of BDO in England, pragmatism as a companion ideal to 'efficiency', was ever present through the historical trajectory of this chapter. Pragmatism means acting in ways according to what is considered achievable, rather than ideal. It is therefore manifestly a 'pessimistic'[18] approach, rather than a hopeful or ambitious ideal for conservation professionals to be adopting in droves. The invention of emission reduction credits under the CAA was an overtly pragmatic compromise between economic growth and environmental goals. Pragmatism was the reason why regulatory innovations ushered in a new era of 'environmentally attuned development' that more or less permitted industry to continue business as usual. The translations of the aggregate rules to other areas of environmental policy were enacted in the name of efficiency and pragmatism. As Pawliczek and Sullivan (2011) point out, under these conditions, conservation, counter-intuitively, becomes 'development led'. Funding for biodiversity protection or enhancements becomes bound to the spatial, temporal and financial dynamics of infrastructural or residential developments. I return to this idea in the case studies below where I identify that, in contrast to its alleged rationale for 'making space for nature' (Lawton et al. 2010), BDO, in fact, counter intuitively works to make space for development.

In summary, BDO thus emerged within a co-evolutionary relationship between conservation and social and ideological dynamics, or sociological 'values', in the sense that David Graeber (2001) discusses, as well as micro scale histories of individuals negotiating at different moments. The convergence of political and

[18] Environmental philosopher Mike Hannis made this point during a debate with Pavan Sukhdev, author of TEEB, around the ethics of natural capital accounting during the World Forum for Natural Capital 2015 in Edinburgh.

economic technologies (de-regulation, austerity) according to an ideological moment when the Conservative led Coalition came to power in 2010, shaped the rise of, and ultimately the contradictory character of BDO. From origins to theory and implementation, BDO is riddled with paradoxes and tensions. We will observe a number of these struggles in grounded efforts to develop BDO in practice within pilot sites of the DEFRA study. It is to this scale and the detailed empirical engagements with the pilot sites that the discussion now turns.

Figure 6 A time line of policy innovations leading to BDO



Source: Author drawn from multiple sources

PART 3

CHAPTER 5
IN SEARCH OF A 'GOOD BIODIVERSITY YIELD PER HECTARE': THE WARWICKSHIRE, COVENTRY AND SOLIHULL PILOT

5.1 Introduction

This chapter moves the focus of the discussion to the finer scale of BDO and presents details from an in depth empirical engagement with the Warwickshire, Coventry and Solihull (WCS) arm of the DEFRA pilot study. The chapter explores the practices of value making through BDO, *in-situ*. The chapter is organised in five parts. Following the chapter's introduction, I explore the background to WCS's local government environmental and planning policy context and its machinery. I also present some of the material devices that assisted in bridging biodiversity and development plans through the deployment of detailed spatial data with a calculative device named the 'Habitat Biodiversity Audit' (HBA). This section partly answers the first research question by highlighting the assortment of actants that enabled WCS to gather some wind in its sails during the DEFRA pilot. The differences between this pilot site and the others indicate that these elements are pre-requisites for BDO to stabilise. The third section of the chapter presents the working through of a specific BDO contract in WCS. In particular it focuses on the practices of value making using the DEFRA metric. Here I provide detailed empirical data illuminating the practical and messy task of re-interpreting biotic networks and relationships through the frame of a universal biodiversity unit, and demonstrate real examples of ecological commensuration that occur. This section also explores how the scores and the compensation costs attributed to habitat impacts are actively negotiated and struggled over by different actors in the process.

The fourth section investigates the shifts underway pulling the whole BDO project towards a model of habitat banking. Market pressures for delivering economies of scale in offset provision in combination with the specific expertise and interests of the intermediaries involved indicates a re-positioning of conservation in line agricultural production and growth narratives according to a 'good biodiversity yield per hectare'. As soon as the material and conceptual infrastructure of BDO is assembled, some actors disproportionately shaping the arrangements, envisage biodiversity to be able to be harvested from land, much like other agricultural or ecosystem commodities.

The chapter closes by summarising the main findings and expanding the discussion around each, principally reflecting on the shifts to conservation policy and practice that BDO is engendering within this county. The fact that WCS was so successful and displayed almost perfect organisational capacity for realising BDO simply emphasises the significance for these findings and their associated implications for biodiversity considerations within the local government planning processes. It is to this enabling context and wider contextual factors of this assemblage that the chapter now turns.

5.2 Enabling policy structures and wider context - becoming 'bottom up'

The sub region of Warwickshire, Coventry and Solihull (WCS) applied to participate in the DEFRA pilot in 2011 and was accepted into the study on the basis of that it would be coordinated by the ecology department at Warwickshire county council (WCC). Warwickshire, Coventry and Solihull proved to lead the most successful of all the DEFRA pilot sites (in terms of gaining experience) for a variety of reasons that I discuss below. One factor was perhaps attributable to policy changes already underway at WCC. The county council had independently embraced NNL as a new standard in county and district council planning and environmental policy documents. It took its lead directly from Westminster following the appearance of NNL in the NEWP, the NPPF and *Biodiversity 2011-2020* over 2011 and 2012. As such, WCC were able to go further and faster with introducing the DEFRA metric (as the only available calculative means for meeting NNL) and BDO more generally.

WCC had an ambitious ecology unit within a Local Planning Authority with a highly-motivated leader driven to make a tangible difference to the natural environment in the county. This energy is captured in statements such as the one below:

> The biggest driver I have is living within planetary boundaries. Nationally and internationally we are losing biodiversity hand over fist. No net loss is not an option anymore we need net gain to try and recover our planet. This is my biggest issue and I am going to do all that I can to resolve this issue before I pop my clogs. (LPA1-WCS 130217)

So as to be taken into the heart of local plan making procedures, BDO was written in to the WCS Sub-Regional Green Infrastructure Strategy (WCS SRGIS). The WCS SRGIS was formally adopted in 2013 (one year after the pilot started) and sets out the countywide ambitions to deliver strategic long-term benefits in the natural environment. Referred to as the 'centre piece of local government environmental policy', the SRGIS informs the

environmental basis for spatial planning across all district and borough councils in Warwickshire. The SRGIS 'provide[s] evidence for the preparation of plans, policies and strategies relating to Green Infrastructure (GI) at a sub-regional level and at a local level' (SRGIS 2013: 3)[19]. This part is crucial. The SRGIS covered the entire sub-region, incorporating all six district councils in Warwickshire and the two county boroughs of Coventry and Solihull, across what is known as the two-tier system.

WCC had a uniquely strong relationship with the lower tier district councils. The Head of Ecology mentioned that while it was typical at other counties for the two tiers to not 'see eye to eye' he explained, 'they trust me, we have a very good relationship' (LPA1-WCS 130217). Through SRGIS, therefore the standard of net gain and BDO was captured in both tiers of local government planning at once. On account of these policy changes, BDO was much more than simply a 'pilot study phase' antecedent to formal adoption. If anything, it was the other way around. Policy was written so as *to enable* BDO. This capacity and the WCC's ambitions to leverage changes set at national level are what lead the Head of Ecology to refer to the DEFRA metric as a 'gift' from central government (LPA1-WCS 130217). Government's endorsement of a biodiversity metric assisted this programme of work, but in many ways, WCC's pilot was a 'bottom up' approach (LPA1-WCS 130217).

As well as ambitious approaches for reversing trajectories of biodiversity and habitat decline in the county at leadership level, the WCC had uniquely strong organisational and data competencies for an LPA ecology unit. The team was made up of fifteen people, which is very high compared to most local authorities, which often only have one person if any (NGO1 280116). Perhaps crucially, they are also an entrepreneurial department. LPA1-WCS 130217 explains 'we are an income generating unit, we don't get anything from tax payer and that is one challenge'. But this is in part why they were able to take an Environment Bank employee on secondment directly into the department. Warwickshire County Council formed one of the two DEFRA LPA pilot sites that embarked on the study period in partnership with the offset brokering company. The partnership has remained exclusively in place at this site since the end of the pilot in 2014. The other Environment Bank project officer was placed in Essex County Council between 2012-2014

[19] Green infrastructure is defined as 'a network of multifunctional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities' (WCS SRGIS 2013: 3).

but went on to become the Biodiversity Offset Programme Manager at the London Wildlife Trust, acting as the conservation delivery partner to Network Rail's offsetting programme (chapter 7).

Within the WCS pilot, The Environment Bank's project officer (coded henceforth as 'offset broker' OB1-WCS) worked to align and stimulate the market players so as to mobilise the cogs of a fledgling BDO market. Markets require supply and demand, and while the LPA was able to stimulate demand from developers for offset credits (through its 'carrot shaped stick' in the planning application process), the supply side for credits was not forthcoming. OB1-WCS was therefore engaged with soliciting both private landowners and NGO conservation partners as potential receptor sites and biodiversity unit vendors. OB1-WCS also actively refined the DEFRA metric and helped with its interpretation in practice. What later became known as the 'Biodiversity Impact Assessment,' (BIA), the DEFRA metric represented a significant shift to the traditional ecological surveying and EIA requirements. For the BIA to be successfully adopted, local consultant ecologists needed to 'upgrade' their professional working knowledge and translate this across to the BIA methodology. In a general sense, OB1-WCS sought to mainstream BDO throughout the county's ecology and planning private sector consultancies and NGOs by providing guidance, advocacy, training and seminars for these stakeholders. As such OB1-WCS was a lively and influential actor, aligning and smoothing connections between people and devices. The role was principally one engaged with 'making translations' between an old system and a new one - before and after the introduction of BDO policies. In addition to technical translations to a new system, OB1-WCS's work was also one of winning hearts and minds. This effort involved promoting BDO for its potential to deliver promising conservation outcomes through harnessing the powerful multiple win rhetoric of DEFRA's 2013 BDO Green Paper. The laborious work of mainstreaming BDO and making it familiar to users that would take it forward, was a core part of the Environment Bank's business model. As a company, they would benefit directly, since it was set to take a 20 per cent fee for every sum of biodiversity offset compensation that it brokered through the local planning authority (OB1-WCS 241114).

A spatial dimension to the values: The Habitat Biodiversity Audit

In combination with the rapid re-scaling of national policy at the local government level, the presence of rich biological data records also permitted WCS to promptly enact BDO. Warwickshire County Council had what they considered to be probably the 'best habitat data in the country, if not Europe, if not the world!' (LPA01-WCS 130217) LPA01-WCS

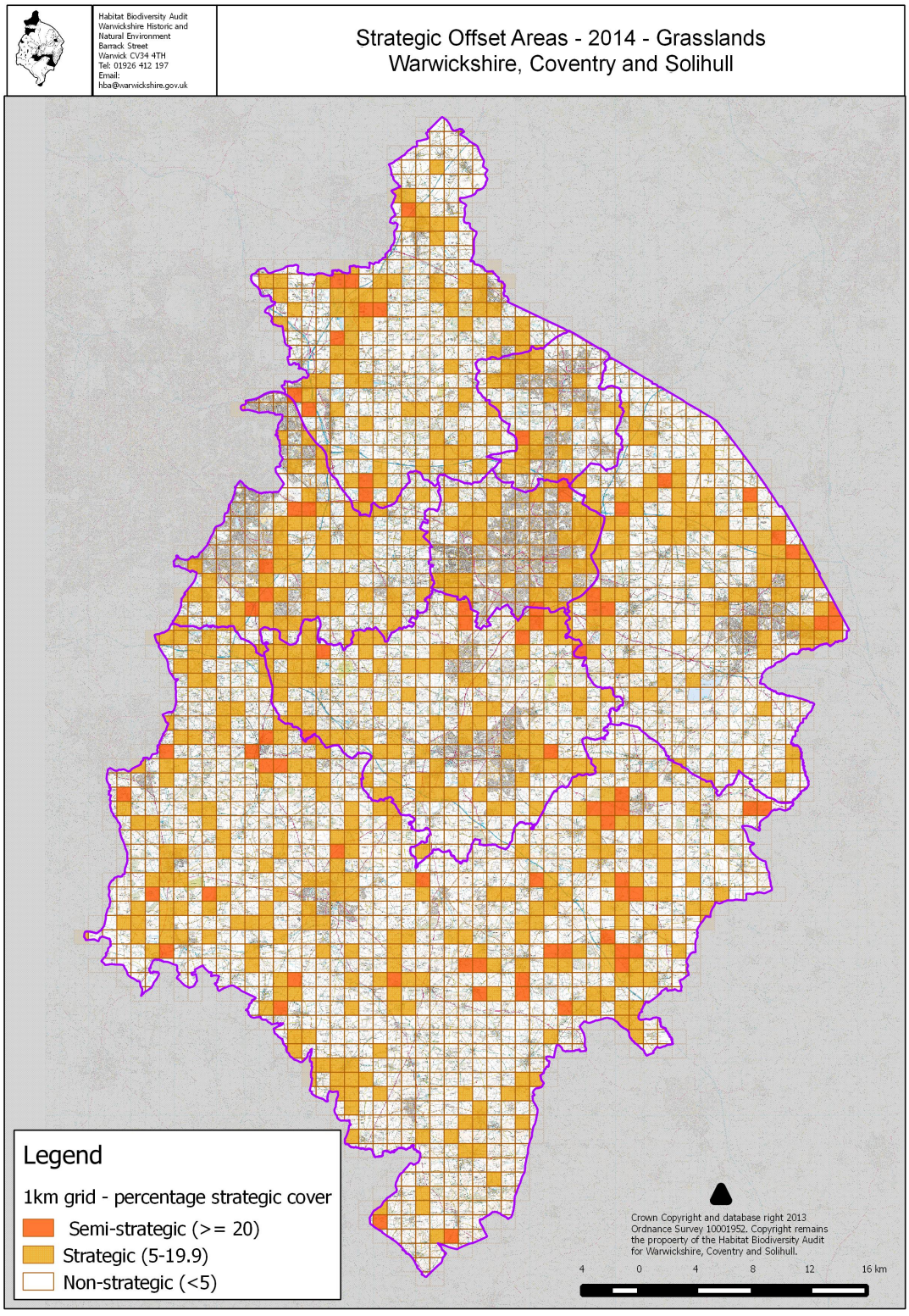
explained that, 'Warwickshire's data is something we are blessed with, it underpins every decision that we make' (LPA1-WCS 130217). This statement refers to the Warwickshire Biological Records Centre (BRC) made up of Geographic Information System (GIS) informed data records and maps of priority habitat areas within the county. The BRC has been operational since 1974 and contains records of over 15,000 species and 2,400 sites (LPA1-WCS 130217). Crucially, for BDO's spatial plan making, it also includes something called a 'Habitat Biodiversity Audit' (HBA). The HBA is made up from polygon data derived from every single field and hedge in the county, which is surveyed by 20 per cent every year to produce a complete and rolling 'audit' of spatial habitat indicators every five years. As an archival resource created through an on-going partnership managed by the local Wildlife Trust in collaboration with the University of York, the HBA represents core habitat areas and provides an aerial picture of the habitat connectivity and functionality within the county drawn from Moilanen and Nieminen (2002). This includes habitat connectivity for woodland, grassland and wetland habitat categories (Figures 7 and 8 illustrate these for woodland and grassland). These maps are based on a 1km range dispersal of species and habitat distinctiveness mapping.

The HBA provides a cartographic data infrastructure compatible with BDO approaches since it identifies and delineates sub regional 'biodiversity assets' and categorises biodiversity strategic areas within the region. The layering of maps with databases of biological records echoes what Latour (1987) and Callon and Muniesa (2005) refer to as a 'metrological network'. Configurations of data practices stabilise the ordering and valuing of ecological spaces as 'assets' and 'targets' and in so doing provide a mapping facility as the basis for BDO's spatial habitat placement strategy. Using the SRGIS, the WCC seeks to connect the green infrastructure assets together to form core areas creating larger functional clusters of woodland, wetland and grassland habitats. The goal is to build up in increasing scale of habitat connectivity by connecting these large functional ecological areas together (Sub Regional Green Infrastructure Strategy 2013). Using the SRGIS and the HBA, BDO is afforded a spatial rationalising logic in seeking to improve habitat connectivity across the county. The goal is for BDO to maximise its potential to spatially order the development driven biodiversity compensation. The HBA was considered to be an essential tool for this process. In particular, it shapes the value calculations for biodiversity investments in different places according to their proximity to or overlaps with the core habitat priority areas. For example, if an offset is to be delivered within a non-strategic area according to the HBA map then the metric's spatial risk multipliers would de-value the offset site by a factor of three. The consequence of

this de-valuation would mean that the offset site itself would need to deliver three times the number of units to meet the credit unit requirements as compensation for the impact. Usually the easiest way of achieving this was to simply expand the physical area by a factor of three.

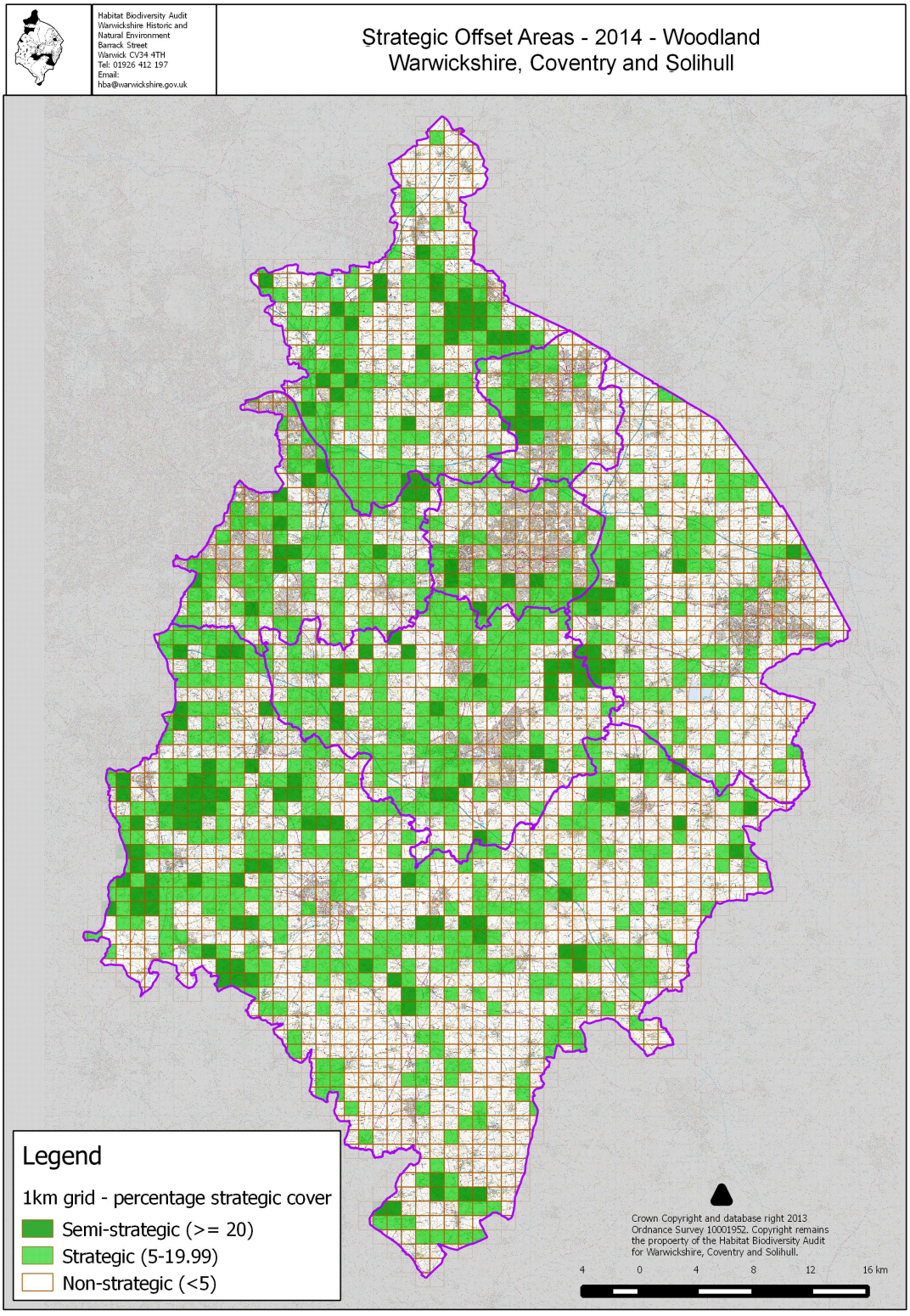
So that an increase in spatial area (as one attribute of the DEFRA metric) can act as a biodiversity value compensation, a commensuration translation occurs so that multiple value fields appear as equivalent standards. I examine this practice of commensuration across the different value units - between hectares and biodiversity units in more detail in the next section of this case study. Similarly, if the LPA, broker or developer can find a receptor site for an offset within the habitat priority zones outlined in the HBA, then the reverse is true. In these circumstances, a smaller spatial area in hectares will suffice as compensation since it can offer a higher number of units per hectare. The value, or 'yield' of this strategically placed site will be larger.

Figure 7 Sub Regional core area map of grasslands



Source: Warwickshire Coventry and Solihull Sub-Regional Green Infrastructure Strategy 2013

Figure 8 Sub Regional core area map of woodland



Source: Warwickshire Coventry and Solihull, Sub-Regional Green Infrastructure Strategy 2013

Mapping of ecological 'assets' with an 'audit' helps planners decide where development and nature should *be* within the county council boundaries. The HBA priority habitat framework imposes a value grid that penalises less favourable placements and rewards alignment with its target locations. This spatial resource forms WCS's unique methodological and strategic capacity for undertaking BDO. It informs the decisions that planners and ecologists need to make so as to allocate where nature impacts and gains could be strategically placed as well as development driven land use changes. This spatial planning capacity is a vital facet of the WCS approach. It's implications for spatial rationalisation is something that I return to in the discussion section of this chapter.

Planning context and development pressures

The county faces significant development pressures over the next 25 years in part due to its relatively flat and therefore developable topography, geographical location in England and demographic and economic trends (NGO1-WCS 241114). For this reason, the county was particularly susceptible to the pro-development planning reforms delivered from the new Coalition Government. The 'presumption in favour of sustainable development', re-interpreted through local government strategy Local Plans as the 'golden thread running through plan making' (DCLG 2012: 4) aligns with Government's expectations that:

> the planning system does everything it can to support sustainable economic growth. Therefore, significant weight should be placed on the need to support economic growth through the planning system. (DCLG 2012: 6)

For example, one of the county's district council's Local Plans 2011-2029 states that:

> When considering development proposals, the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. It will work proactively with applicants to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in the area… it is important that the planning system does everything possible to support economic growth and sustainable development. (Warwick District Local Plan 2011-2029: 17-18)

The delivery of houses and house building is central to the vision for 'sustainable development'. The 2013 *Warwickshire and Coventry Strategic Market Housing Assessment* (WCS SMHA) review provides the targets for local authority housing delivery between 2013 and 2031 across all six district council local planning authorities.

This assessment sets out the need for the WCC to deliver somewhere between 67,500 and 73,000 new residential dwellings over an eighteen year period (WCS SMA 2013). According to figures from the Campaign to Protect Rural England (CPRE) and Housing Foresight (Burroughs 2015), the average residential dwelling density in 2011 in England was 42/ ha. This number of new houses then might equate to 1700 hectares (almost seven square miles) of land use change subject to residential development over the period. Alongside house building, a full spectrum of employment and commercial developments, major mixed developments, national infrastructure projects and minerals extractions also make up planning applications for proposed spatially driven land use changes submitted and administered by the council planning departments.

Spatial strategies

Space, it seems then, is at the heart of both development and environmental agendas at national as well as local government levels. For example, a diagnosis of the causes and solutions for biodiversity loss in the UK has been laid squarely within a spatial framework encapsulated by the pithy but powerful campaign for 'more, better, bigger and better connected space for nature' within the 2011 Lawton Report that goes by the same name; *Making Space for Nature (*Lawton et al. 2010). The goal to improve ecological connectivity and reduce fragmentation is one of the drivers underlying the promotion of BDO to organise spatial placements of habitat. In line with this thinking, the WCC problematises, specifically in spatial terms, the dismal state of biodiversity and habitat indicators within the county against the CBD biodiversity habitat area targets and standards. In their application to become one of the 50 government backed Local Nature Partnerships proposed in the NEWP in 2011, WCC states:

> Our area of around 2 per cent of high quality wildlife assets is woefully short of the Nagoya Commitment aspiration of 17 per cent. Using this measure to estimate what is required, approximately 38,200 hectares of high quality natural habitat will be needed to redress the balance between semi-natural vegetation and other uses. Our highly-fragmented landscape is currently unlikely to deliver the ecosystem services set out in the Natural Environment White Paper.' (Warwickshire Local Nature Partnership application 2012)

WCS's spatially driven environmental planning is set out in the SRGIS and described as:

> where wildlife thrives alongside humans within a resilient landscape; where land and buildings are managed positively for biodiversity, and where

> biodiversity enhancements are embedded into development, contributing to the extension and joining up of existing biodiversity assets.' (Sub Regional Green Infrastructure Strategy 2013: 19).

The SRGIS proposes that for the purposes of identifying and managing its 'assets', green infrastructure here is divided into what it refers to as 'three disciplines' (or mechanisms for delivery) - 'Landscape', 'Accessibility' and 'Planning'. Planning is disproportionately emphasised over the others. Within planning, BDO is presented as the leading mechanism for meeting biodiversity priorities within the county planning processes. Therefore, for all the variety of governance approaches for conservation within local government, planning is the main 'discipline' and within that, BDO is paramount. This hierarchy of mechanisms therefore supports theoretical perspectives that conservation under BDO is primarily and counter-intuitively a 'development led' strategy (Pawliczek and Sullivan 2011, Sullivan and Hannis 2012).

The combination of influential individuals, institutional capacity, its partnership with the Environment Bank and powerful devices such as the Habitat Biodiversity Audit all played central explanatory roles in accelerating BDO at WCS. This combination of elements therefore destined the pilot here to achieve significantly more experience than the others in making a transition towards a BDO approach. In relation to this, LPA1-WCS also uniquely transcended county borders to participate in wider BDO assemblages at national and international scales. For example, LPA1-WCS frequently appeared at international meetings, conferences and provided webinars for an international audience. This included the Chartered Institutite for Ecological and Environmental Management (CIEEM) Spring Conference on biodiversity offsetting in 2014 [20]. Furthermore, LPA1-WCS was also the only LPA pilot leader to participate as a speaker and panellist at the BBOP, DEFRA and ZSL summit *Towards a No Net Loss of Biodiversity and Beyond* in June 2014. More latterly LPA1-WCS hosted an international BBOP community of practice webinar in February 2017. The enactment of BDO at an English LPA level is an important resource for BBOP to share with the wider international community. It proved to be such a rich source of evidence, that over half of the entire official DEFRA evaluation study on the LPA pilot sites is dedicated to the WCS pilot (Baker et al. 2014b). The contrasts between the ways this case study is therefore

[20] CIEEM Spring Conference 2014; *Biodiversity offsetting: from theory to practice* in Birmingham.

presented in official accounts, my research and those in BBOP and DEFRA's is also potentially illuminating for further appreciating the ways in which epistemic communities filter accounts for different audiences. I will return to this idea in chapter 8. For now, though, the discussion moves on to present an actual exercise in valuing biodiversity through the offsetting mechanism, and in particular - the application of the DEFRA metric.

5.3 Practices of commensuration: a case study

This planning application and associated attempts to secure compensation through BDO was one of the comparatively advanced attempts to develop a full offset exchange from the local government pilots within the DEFRA study[21]. Even so, over the course of my research period (April 2013 - April 2016), the county council had not successfully managed to deliver a complete offset. The biggest barriers to progress for the development of BDO in England have been the identification and preparation of suitable receptor sites for the offsets (also noted by the evaluation report, Baker et al. 2014a). All the same, the case study reflects an anomalous progression in applying calculative processes and aligning social actors to establish the shape and design of an offset between a development and receptor site. Here, I present a case where the development site was subjected to the DEFRA metric, a receptor site was identified, calculations were prepared for the issuance of credits and a 30 year ecological management plan designed and costed thereby offering the price of the offset. Notably however, the developer then rejected this offset site in favour of developing an offset arrangement with the farmer issuing the land for development in the first place. The new arrangement was agreed at the end of 2015 and no further data were collected in relation to this. The case study here nevertheless is valuable to demonstrate the application of the metric to development and receptor sites to illustrate the social and material practices shaping the production of biodiversity values.

The development

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[21] The empirical research within this chapter forms the basis for a published journal paper and book chapter that is currently under review, both of which are co-authored with Professor Sian Sullivan. The journal article entitled, *'How economic contexts shape calculations of 'yield' in biodiversity offsetting'* was published in Conservation Biology (Carver and Sullivan 2017). The book chapter, *Creating conservation values under DEFRA's biodiversity offsetting pilot and the pragmatics of a using a calculative device* is a chapter within the collected Routledge edition *Creating Values that Matter: valuation systems in development, environment and conservation* (Carver and Sullivan forthcoming).

The case study follows a planning application subject to BDO compensation payments in line with the calculated value of impacted biodiversity at a development site. The planning application was for the delivery of 236 residential properties along with a new football stadium, eight playing fields and bowls club across thirteen hectares of largely agricultural fields. The ecological survey produced by the developer's consultant ecologists show that the baseline habitats of the development site consist of amenity and improved grasslands, hedgerows, scattered tall ruderal vegetation and four ponds, one with great crested newts, which are protected under the UK's Conservation of Habitats and Species Regulations 2010.

The site is bounded to the north by an industrial and residential development, with roads bordering the west and east side of the site and open countryside beyond. It forms the south-western fringe of a small medieval market town and civil parish with a population of around 6,500 recorded in 2011 (Warwickshire Observatory 2011). The development planning application was submitted in March 2013 to the district council by the existing owners, the local football and bowls club in conjunction with a large national residential developer who would oversee the bulk of the planning process and through whom the residential properties would be built, marketed and sold. This case study reflected one of the many development sites that was subjected to calculated losses of biodiversity over the course of the DEFRA pilot period at WCS with the view to sourcing equivalent gains at a development site to produce the complete offset. As such the local planning authority requested that the planning application be supplemented with a further habitat evaluation compatible with technical guidance of the DEFRA metric, now referenced locally as the Biodiversity Impact Assessment (BIA). The purpose was to assess the impacts, mitigation measures and to inform necessary compensation for the development. Figure 9 illustrates the aerial view of the development site with the BIA habitat codes prior to and proposed transformation post development.

Figure 9 Maps of development site before and after proposed developments

Source: Consultant ecology Ecological Assessment Report. March 2013, available publicly at WCS online planning application archives

Calculating values with the Biodiversity Impact Assessment

As is customary with the submission of a planning application, the developers' consultant ecologists completed primary habitat surveys as the basis for preparing the Ecological Impact Assessment report (EIA). To supplement the survey data, the consultants drew from secondary existing records derived from earlier surveys of the site. Subsequently, the contents of the EIA were translated into the Biodiversity Impact Assessment (BIA) by a LPA ecologist with assistance from the Environment Bank officer (OB1-WCS). The 'translation' was a desk based exercise seeking to establish the site's biodiversity baseline and mitigation unit values in a format necessary for BDO under the DEFRA pilot. The BIA was an Excel spread sheet that the WCC had created and specifically formatted to capture the attributes and exchange rules of the DEFRA metric. The largely qualitative habitat data contained in the EIA was coded into this spread sheet. The BIA calculator categorised spatial areas of the development site across the separate rows of the worksheet. Each row on the worksheet denoted a separate parcel of habitat (shown as codes on the top image in Figure 9). Along these rows, each parcel was scored a corresponding column value denoting the habitat type, the habitat code relating to this, size in hectares, and numerical category scores for habitat distinctiveness and condition (see Table 7 and Figure 10).

The BIA spread sheet performs three stages of calculation to arrive at the scores of residual net losses or potential gains. The calculation first (Table 7 rows 15-28) generates a 'Habitat Impact Score' (HIS) as the baseline, which is the total scored habitat on site prior to the development, in this case 46.68 biodiversity units (cell O53). It is named the Habitat Impact Score because the design of the metric assumes that all existing habitats (comprising the whole baseline score) are lost to development prior to on site works to mitigate these impacts.

The second step (Table 7 rows 59-70) calculates the Habitat Mitigation Score (HMS), to denote the total number of biodiversity units that will be restored or created onsite to 'mitigate' or minimise the projected losses. The HMS score on the calculator for this development is 16.78 units (Table 7 O89). The process of calculating the HMS entailed overlaying the existing habitat site map and those of proposed onsite ecological works (mitigation) to be completed as part of the development. Through comparing what is lost and gained onsite and coding the differences as habitat target values according to size, distinctiveness and condition, the LPA ecologist could identify what the residual 'net loss' would be and how much compensation work would be required as an investment in additional and measurable biodiversity unit value at an offset site. This

sum comprising the net loss or gain value is the Habitat Biodiversity Impact Score (HBIS) (cell O91). The final calculation to establish the biodiversity loss at a development site seeking compensation is as follows:

Habitat Mitigation Score (HMS)- Habitat Impact Score (HIS)
= Habitat Biodiversity Impact Score (HBIS)
16.78 units (habitat creation) - 46.68 units (baseline habitats)

= - 31.90 units (net loss of habitat)

The HBIS produced a calculated net loss of 31.90 biodiversity units (Table 7, cell O91) that required an offset to satisfy the mitigation and compensation requirements for impacted biodiversity

Table 7 Biodiversity Impact Assessment spread sheet reproduction
(version 17.4, draft 1) used in biodiversity impact assessments to calculate the residual losses of biodiversity from development impacts

	A[a]	B	C	D	E	F	G	H	I	J	K	L	M	N	O
11															
12			Existing habitats on site			Habitat distinctiveness		Habitat condition		Habitats to be retained with no change within development		Habitats to be retained and restored within development		Habitats to be lost within development	
13		T.note[b]	habitat code	phase 1 habitat description	habitat area (ha)	distinctiveness	score	condition	score	area (ha)	existing value	area (ha)	existing value	area (ha)	existing value
14				direct impacts and retained habitats			A		B	C	A × B × C = D	E	A × B × E = F	G	A × B × G = H
15		F1	B4	grassland: improved grassland	1.78	low	2	moderate	2					1.78	7.12
16		P1	G1	wetland: standing water	0.01	high	6	good	3					0.01	0.14
17		P1	B4	grassland: improved grassland	3.10	low	2	moderate	2					3.10	12.40
18		F2	C31	grassland: amenity grassland	0.18	low	2	moderate	2					0.18	0.70
19		Bowling green	J12	grassland: amenity grassland	0.12	low	2	poor	1					0.12	0.24
20		F6	J12	grassland: amenity grassland	0.97	low	2	poor	1					0.97	1.94
21		West of football grid	B4	grassland: improved grassland	0.08	low	2	good	3					0.08	0.48
25			n/a	built environment: buildings/ hardstanding	0.32	none	0	poor	1					0.32	0.00
26		F3	B4	grassland: improved grassland	4.88	low	2	moderate	2					4.88	19.52

27	Slurry pit	G1	wetland: standing water	0.01	high	6	poor	1					0.01	0.05	
28	Part of F4 and F5	B4	grassland: improved grassland	1.52	low	2	moderate	2					1.52	6.08	
45	Total			12.96				Total	0.00	0.00	0.00	0.00	12.96	48.68	
46														ΣD+ΣF+ ΣH	
47												site habitat biodiversity value		46.68	J
48	Indirect impacts, including offsite habitats			K					value of loss from indirect impacts[c]						
49	Before or after impact								K × A × B = Li, Lii	Li- Lii					
50	Before														
51	After														
52	Total			0.00					M	0.00				HIS = J + M	
53											habitat impact score (HIS)			46.68	
54	Caution: Destruction of habitats of high distinctiveness, e.g. lowland meadow or ancient woodland, may be against local policy. Has the mitigation hierarchy been followed, can impact to these habitats be avoided? Any unavoidable loss of habitats of high distinctiveness must be replaced like for like.														
55															

56		Proposed habitats on site (onsite mitigation)		Target habitat distinctiveness		Target habitat condition		Time till target condition		Difficulty of creation or restoration		Habitat biodiversity value
57			phase 1 habitat description	habitat area (ha)	distinctiveness	score	condition	score	time	score	difficulty	score	
58			habitat creation	N		O		P		Q		R	(N × O × P)/ Q/R
59	F1 & F6	n/a	Built environment: buildings or hardstanding	2.27	none	0	poor	1	5 years	1.2	low	1	0.00
60	F1 & F6	n/a	built environment garden (lawn and planting)	0.76	low	2	poor	1	5 years	1.2	low	1	1.27
61	F2, F3, F4	n/a	built environment: buildings or hardstanding	4.02	none	0	poor	1	5 years	1.2	low	1	0.00
62	F2, F3, F4	n/a	built environment: gardens (lawn and planting)	1.34	low	2	poor	1	5 years	1.2	low	1	2.23
63		J12	grassland: amenity grassland	2.44	low	2	poor	1	5 years	1.2	low	1	4.07
64	Area 4	B22	grassland: semi-improved neutral	0.76	medium	4	good	3	15 years	1.7	medium	1.5	3.58

65	Area 3	G1	wetland: standing water	0.13	high	6	good	3	15 years	1.7	medium	1.5	0.92
66	Area 1	B22	grassland: semi-improved neutral grassland	0.16	medium	4	good	3	15 years	1.7	medium	1.5	0.75
67		G1	wetland: standing water	0.05	high	6	good	3	15 years	1.7	medium	1.5	0.35
68	Landscape	A112	woodland: broadleaved plantation	0.16	medium	4	good	3	32+ years	3	medium	1.5	0.43
69	Area 2	B22	grassland: semi-improved neutral grassland	0.19	medium	4	good	3	15 years	1.7	medium	1.5	0.89
70		B22	grassland: semi-improved neutral grassland	0.73	medium	4	moderate	2	15 years	1.7	medium	1.5	2.29
71	Total			13.01	ERROR: total area of habitats created must equal total area of habitats lost								
72	Habitat restoration							existing value S (=F)					((N × O × P)- S)/ Q/ R
88			Total						trading down correction value				0.00

89	habitat mitigation score (HMS)	16.78
90		HBIS-HMS = HIS
91	habitat biodiversity impact score	-31.90
92	percentage of biodiversity impact loss	65.53

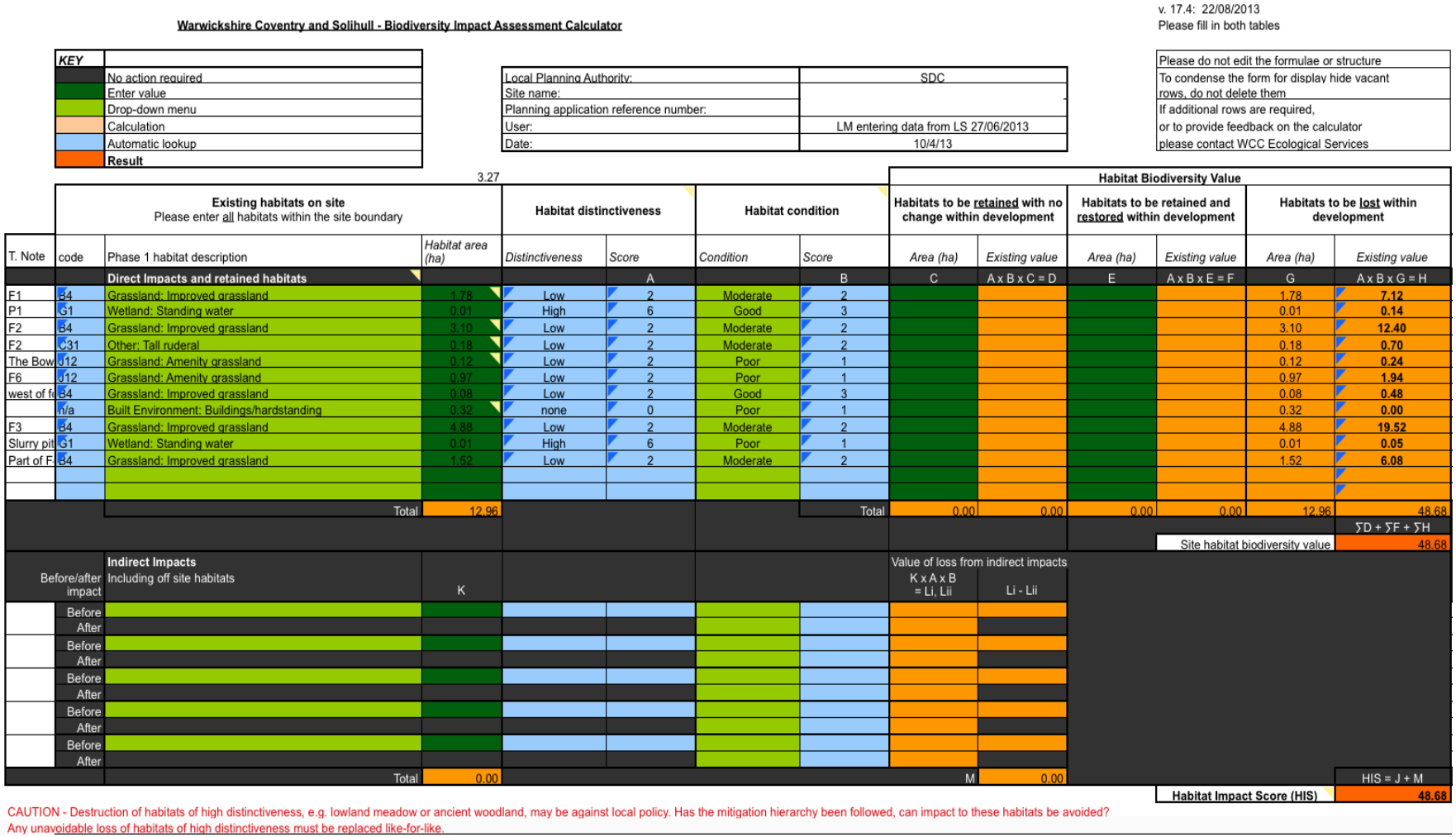
Source: Author adaptation from original BIA shown as Figure 10.

[a] Numbers across rows 15-28 are multiplied to produce the habitat biodiversity value for each coded area subject to development. Numbers are rounded to 2 decimal places and as such, if calculated manually here may produce different results. The sum of the values in column O for rows 15-28 (shown in cell O53) is the biodiversity baseline of the habitat impact score (HIS). In rows 59-70 numbers across rows are multiplied to produce the habitat-mitigation score (HMS) (cell O89), which is the value of habitats that will be restored or created onsite so as to mitigate or minimise projected biodiversity losses.

[b] T note refers to the 'target' area as habitat parcels subject to impacts coded on the development maps.

[c] Left empty on original BIA

Figure 10 Original Biodiversity Impact Assessment spread sheet



Warwickshire Coventry and Solihull - Biodiversity Impact Assessment Calculator

v. 17.4: 22/08/2013
Please fill in both tables

KEY	
	No action required
	Enter value
	Drop-down menu
	Calculation
	Automatic lookup
	Result

Local Planning Authority:	SDC
Site name:	
Planning application reference number:	
User:	LM entering data from LS 27/06/2013
Date:	10/4/13

Please do not edit the formulae or structure
To condense the form for display hide vacant rows, do not delete them
If additional rows are required, or to provide feedback on the calculator please contact WCC Ecological Services

3.27

		Existing habitats on site (Please enter all habitats within the site boundary)		Habitat distinctiveness		Habitat condition		Habitat Biodiversity Value: Habitats to be retained with no change within development		Habitats to be retained and restored within development		Habitats to be lost within development	
T. Note	code	Phase 1 habitat description	Habitat area (ha)	Distinctiveness	Score	Condition	Score	Area (ha)	Existing value	Area (ha)	Existing value	Area (ha)	Existing value
		Direct Impacts and retained habitats			A		B	C	A x B x C = D	E	A x B x E = F	G	A x B x G = H
F1	B4	Grassland: Improved grassland	1.78	Low	2	Moderate	2					1.78	**7.12**
P1	G1	Wetland: Standing water	0.01	High	6	Good	3					0.01	**0.14**
F2	B4	Grassland: Improved grassland	3.10	Low	2	Moderate	2					3.10	**12.40**
F2	C31	Other: Tall ruderal	0.18	Low	2	Moderate	2					0.18	**0.70**
The Bow	J12	Grassland: Amenity grassland	0.12	Low	2	Poor	1					0.12	**0.24**
F6	J12	Grassland: Amenity grassland	0.97	Low	2	Poor	1					0.97	**1.94**
west of f	B4	Grassland: Improved grassland	0.08	Low	2	Good	3					0.08	**0.48**
	n/a	Built Environment: Buildings/hardstanding	0.32	none	0	Poor	1					0.32	**0.00**
F3	B4	Grassland: Improved grassland	4.88	Low	2	Moderate	2					4.88	**19.52**
Slurry pit	G1	Wetland: Standing water	0.01	High	6	Poor	1					0.01	**0.05**
Part of F	B4	Grassland: Improved grassland	1.52	Low	2	Moderate	2					1.52	**6.08**
		Total	12.96				Total	0.00	0.00	0.00	0.00	12.96	48.68
													∑D + ∑F + ∑H
											Site habitat biodiversity value		48.68

Before/after impact		Indirect Impacts (Including off site habitats)	K					Value of loss from indirect impacts: K x A x B = Li, Lii	Li - Lii
	Before								
	After								
	Before								
	After								
	Before								
	After								
	Before								
	After								
	Before								
	After								
		Total	0.00					M	0.00
									HIS = J + M
									48.68
									Habitat Impact Score (HIS)

CAUTION - Destruction of habitats of high distinctiveness, e.g. lowland meadow or ancient woodland, may be against local policy. Has the mitigation hierarchy been followed, can impact to these habitats be avoided?
Any unavoidable loss of habitats of high distinctiveness must be replaced like-for-like.

Source: OB1-WCS 241114

The receptor site

Established conservation NGOs and Wildlife Trusts are often preferred partners in delivering compensatory conservation to mitigate development impacts as they typically possess the right 'experience and expertise to ensure delivery' (LPA1 - 020714), as well as being familiar and experienced with this type of contracted management for habitat creation. The offset site in this case, was a site owned and managed by a local conservation NGO, which acquired it in 2013. The site was a 5ha grassland meadow 5km northeast of the development, and had been identified by the Environment Bank at WCC for the supply of offset credits equivalent or greater to the 31.90 units produced through the HBIS. The meadow was species rich, semi-improved grassland in close proximity to a local Site of Special Scientific Interest (SSSI), and currently home to five species of orchid including the largest population of greater butterfly orchid (*Plantanthera chlorantha)* in the county. It also contained four of the county's six rare farmland butterflies, three of these, the grizzled skipper (*Pyrgus malvae),* the dingy skipper *(Erynnis tages)* and the white-letter hairstreak (*Satyrium w-album)* are nationally designated as biodiversity priority species under the 2007 UK BAP. It was hoped that with the correct interventions that two other rare farmland butterflies, also designated nationally as biodiversity priority species, could establish colonies in this field.

The meadow was acquired by the wildlife and conservation NGO because of the excellent ecological enhancement potential it demonstrated. Although the NGO bought the site for this reason, it did so with the intention of performing only minimal conservation work due to a shortage of available funding. The work to be completed over and above these primary conservation activities by the NGO, and facilitated through the offset payment is considered to be the biodiversity 'additionality' stipulated as a BDO design principle. The NGO intended to bring the meadow grassland into a moderate condition, but with the offset money they would 'return it to fully favourable condition of national importance' (Biodiversity Offset Management Plan 2014: 6). In line with its ecological profile and the site's aesthetic qualities, the wildlife conservation NGO promote this nature reserve as a one of the top five meadow walks in the county, and would receive money from the development compensation finance over a 30 year offset period.

Pricing the offset and trading biodiversity 'value'

So as to match units of gain against ones of loss, the final calculative stage of the procedure entailed using the BIA metric to perform the equivalent category and coding

work on the plot allocated to be a receptor or offset site. The conservation NGO quantified this proposed biodiversity gain or 'yield' and enumerated the expected costs of producing it according to a biodiversity offset management plan (BOMP). The BOMP was written by a conservation officer at the NGO. The costs of providing the credit value for offsets typically derive from labour, materials and capital or lease payments for the land itself (NGO2-WCS 280115). The purchase of the land did not apply here since the NGO had already bought the site the previous year. The BOMP, therefore outlined a series of labour costs based on the combined workforce of the NGO volunteers, conservation staff and external contractors (NGO2-WCS 280115). It also contained the long term visions, management, objectives and strategy for each compartment of habitat of the site. Furthermore, it outlined a series of quality indicators of success and the management prescriptions and monitoring requirements. The predicted budget for 30 years of management at the grassland meadow offset site was £204,076, of which £98,030 would come from the conservation NGO budget and £106,046 from the biodiversity offset payment made by the developers (BOMP 2014). In surplus to these costs, the developer would have to pay an additional 20 per cent of the offset compensation as broker fees, which would go to the Environment Bank (OB1-WCS 241114), plus legal fees for arranging the contracts between parties (NGO2-WCS 280115).

The BIA the county council were using at this stage was version 18.4, but it was hoped that the next version of the BIA from version 19 onwards would include stabilised estimates and calculations for the expected costs associated with activities required to deliver the types of habitats that are sought as compensation. During the course of the fieldwork the county council were working on assembling what they termed 'more realistic information for management costs' (LPA1-WCS 020714*)* so that this information could synchronise with the results of the BIA revealing the net loss at the development site. The benefits of having these management costs accessible and produced up front would be to eliminate the need for a management plan to be produced by an offset provider at all and therefore speed up the process. Bespoke management plans to inform prices could not easily be produced in a time frame compatible with the planning system nor provide the much coveted 'certainty' around costs for the developer (NGO1 280114).

'Something we can live with'; establishing a balance of values through the 'right' numbers

Tracing over time the successive adjusted calculations for the HMS, HIS and HBIS value scores reveals that the final net loss calculation of 31.90 units was in fact the outcome of negotiations between stakeholders rather than a neutral technical process. These

negotiations entailed adjustments to the category designations and therefore the input values on the BIA spread sheet. Over the course of the planning process, the calculated baseline value of the development site had been reduced by almost 48 per cent from 48.68 (BIA draft 1) (c.f. Table 7) to 25.52 units in the second draft through making category changes to the condition of existing habitats onsite. This downward recalculation of habitat value occurred through making category changes to the condition of existing habitats thereby adjusting the numerical unit outcomes of assigned habitat values (Table 8). Modifications regarding anomalous local level category values (for example, concerning what value scattered trees should have) can be made in anticipation of the numerical and financial outcomes that will arise through the multiplication or division effects of these modifications on biodiversity loss (Habitat Impact Score) or onsite mitigation (Habitat Mitigation Score). In other words, the ability of these modifications to either enlarge or shrink the final compensation costs of development planning applications has been built into prior understanding of the numerical adjustments that have followed. Other iterations to the metric over the course of the pilot study included adding category values to the BDO metric (Table 6, chapter 4) with the odd numbers 1, 3 and 5 for local habitat types that have greater regional than national distinctiveness and rarity (NGO1-WCS 241114), and extensive formatting changes and editions to make the calculator more 'user-friendly' and manageable (OB1-WCS 050114).

Table 8 Changes in calculated biodiversity baselines between Biodiversity Impact Assessments drafts 1 and 2 after negotiation

BIA Habitat Area Code	Habitat description	Area (ha)	Distinctiveness		Condition		Original unit value - draft 1	New unit value - draft 2	Reduction in unit value
			Category change	Score change	Category change	Score change			
F1	Improved grassland	1.78	None	None	Moderate to poor	2 to 1	7.12	3.56	50%
P1	Wetland-standing water	0.01	None	None	Good to moderate	3 to 2	0.14	0.01	93%
F2	Improved grassland	3.10	None	None	Moderate to poor	2 to 1	12.40	6.20	50%
F2	Tall Ruderal	0.18	None	None	Moderate to poor	2 to 1	0.70	0.35	50%
The Bowling green	Amenity grassland	0.12	None	None	None	None	0.24	0.24	0%
F6	Amenity grassland	0.97	None	None	None	None	1.94	1.94	0%
West of football grid	Improved grassland	0.08	None	None	Good to moderate	3 to 2	0.48	0.32	33%
F3	Improved grassland	4.88	None	None	Moderate to poor	2 to 1	19.52	9.76	50%
Slurry pit	Standing water	0.01	High to low	6 to 2	None	None	0.05	0.02	60%
Part of F4 and F5	Improved grassland	1.52	None	None	Moderate to poor	2 to 1	6.08	3.04	50%
Total							48.68	25.52	48%

Table 8 shows the changes made to the condition values in each parcel of the baseline habits at the development site and the effects of their adjustment on the calculated value outcomes. I compiled this table through comparing different drafts of the BIA excel sheets and combined this numerical and spread sheet analysis with interviews with the district council ecologist (LPA2-WCS 300714), the offset broker (OB1-WCS 300714) and the developer (DEV1-WCS 100215). Changes made to the spread sheets over time included lowering the perceived condition of 7 out of 10 habitat parcels making up the development site. The greatest score changes of these adjustments arose from the larger habitat parcels. The largest habitat parcel is highlighted in the table and shows how the 4.88 ha patch of improved grassland on the development site was downgraded from a baseline condition score of 'moderate' to 'poor'. The outcome of this adjustment reduced the baseline value of this habitat parcel from 19.52 units on (shown on Table 7 cell O26) to 9.76 units. Due to this parcel's size, this single modification created an almost 20 per cent overall reduction to the baseline biodiversity value for entire site. The same process was also applied to improved grasslands in different compartments in habitat area codes F1 and F2.

While WCC was comparatively well resourced in comparison with other LPA ecology units, there was still no way that every development site could be visited by council ecologists to iron out these kinds of uncertainties in habitat condition. Only a handful of development sites are visited and verified by a county ecologist (LPA2-WCS 241114). It is expected that this difficulty would be even more acute elsewhere due to the widespread shortage of ecological expertise within local governments more generally (NGO1 290116). Often the ecological data is assembled and cross-referenced remotely. Local authority ecologists will use the data within the EIA report submitted in support of the planning application and draw on GIS derived biological and historical archives held on file at the council offices at the district council's Biological Records Centre.

Underlying this overall downwards recalculation of the development site's baseline value from 48.68 to 25.52 units was a view that the first calculation was deemed to create too large a future compensation package, thereby threatening the financial viability of the residential development (DEV1-WCS 060315). The initial calculation for the biodiversity offset compensation package was £300,000. During the course of an hour and a half meeting between the developer and the local planning authority, and at the instigation of the development firm, the baseline habitat condition assessments for many areas onsite were adjusted downwards to produce the new figure of 25.52 biodiversity units in the second draft. This led to a revised cost for the final compensation package of

somewhere around £120,000. The developer described this new adjusted figure to me as 'something we could live with' (DEV1-WCS 060315). The revenue that the developer could expect from the sale of these 234 houses would nevertheless be many tens of millions of pounds.

Commensurating 'fields' of value

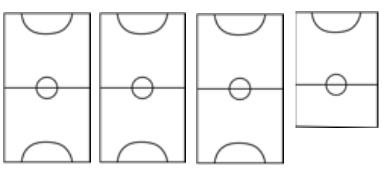
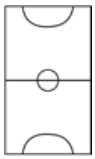
In addition to accommodating adjustments and obscuring these as technical decisions, the BIA also renders equivalent otherwise incommensurable orders of value in dissimilar units of measurement. Practices of commensuration permitted the translation of spatial measurements as hectares into biodiversity 'value' measurements as units. This equivalence is achieved through quantification, which, as discussed in chapter 2, acts to create a flat system of value. In doing so, these commensuration practices also facilitate an exchange of biodiversity loss for gain premised on the commensuration of discrete habitats that are different not only in type but also size.

Following the downward adjustment of the development site's baseline value discussed above (step 1 in the BIA), the second calculative stage of the BIA metric assesses the onsite mitigation works. This stage provides another opportunity to adjust calculations so as to appease the developers. For the proposed development in the case study outlined here, almost 40 per cent of the onsite mitigation work (that is, onsite habitat creation to 'mitigate' the ecological loss imposed through development) was to be delivered through the creation of ten football pitches of varying sizes. The football pitches were calculated as contributing significant amounts of on-site biodiversity unit value and constituted the largest habitat spatial value of all the mitigation activities. The football fields' overall mitigation value was to be achieved by attributing biodiversity value to the amenity grassland of the pitches themselves (Table 7 cell O63) and through allowing their perimeters to develop into long grassy margins as 'semi-improved grassland' (Table 7 cell O70), as recommended in the EIA Report made by the developers' consultant ecologist. As size acts as a value input into the calculation of overall biodiversity unit value on the BIA, the spatial area of the football pitches and their margins compensated 38 per cent in total unit value for otherwise low biodiversity habitat scores in mitigation value. Although receiving low habitat scores for both distinctiveness (2) and habitat condition (1), the size of the football pitches amenity grassland meant that in five years this aggregate spatial area was calculated to contribute 4.07 units and after fifteen years the grassy margins would contribute a further 2.29 units thereby allowing the football pitches to make up 6.36 units of biodiversity value out of 16.78 units (38 per cent) of total onsite mitigation and habitat creation.

The scored values for the football fields' mitigation functionality thus reduced the perceived total biodiversity impact of the development accordingly and decreased the offset unit requirements by this amount. Questions arise here, such as how a sports pitch matures to become a biodiversity habitat, in particular in contrast with 6.36 units of high quality grassland habitat supporting a range BAP species proposed at the offset site. The proposed mitigation value provided through these sports pitches, measured as habitats of low distinctiveness and poor condition, is achieved principally through acting as the largest 'habitat type' within the development, and thus illustrates the function of numerical abstractions to commensurate distinct biota of very different qualities (Sullivan 2013; Carver 2015 (see Figure 11).

The design principles of UK BDO (discussed in chapter 4) mean that large habitat areas of low biodiversity value can be treated as equivalent to small habitat areas of high biodiversity value. Categorising football pitches as 'habitats' for onsite mitigation saves considerable financial compensation value from the final offset calculations.

Figure 11 One football field can have many 'fields' of value

		Development site	Offset site
Units as value fields	Number (Full size football pitches at 0.64 ha each)		
		3.8	1 (area of land equivalent in size)
	Hectares (spatial area of pitches as habitat)	2.44	0.64
	Habitat type (qualitative category)	Amenity grassland	Species rich semi improved grassland as a lowland meadow
	Biodiversity units	4.07	5.48

5.4 Translating value from the (field) margins

So far, I have presented an in-depth case study that examines the dynamic alignments forming assemblages of BDO as a governance technology at a single locale within England's pilot study. I have explored the processes through which the metric produces and formats an individuated 'biodiversity unit' as a currency destined to circulate between actors within this system. I have also explored how users deploy this device in practice. I have outlined the performative elements of WCS's BDO assemblage as well as some of the tensions inherent in the application of the metric. As previously discussed, one of the most prominent tensions or frictions within this market making assemblage is the recalcitrance of supply side actors (landowners) to furnish the emergent demand of biodiversity offset credits. This challenge was an overwhelming feature of the both pilot sites generally and was noted in DEFRA's official pilot evaluation report (Baker et al. 2014a).

I have already established that conservation NGOs and Wildlife Trusts are often preferred partners for offset delivery since they typically possess the right 'experience and expertise' (LPA1-WCS20714) as well as being familiar and experienced with this type of contracted management for habitat creation. However, the long-term vision for BDO in England according to the Environment Bank and the WCS pilot is one that is principally comprised of diverse private landowning offset providers.

Despite the partnership with the Environment Bank who acted as brokers, progress towards establishing this network of private credit providers had still proved elusive. In 2013, the Environment Bank took the step to strategically partner with another brokerage firm. This new sub-broker was a supply chain sustainability consulting arm and subsidiary of a publically listed agricultural commodities corporation. The parent arm of this new broker, OB2-WCS (interviewees here denoted here as OB2.1 and OB2.2) was a multinational food, ingredients and retail corporation operating across 50 countries worldwide with an annual revenue of £13.4b**.** The website advertises that:

> It is our unique role up and down the food chain and our breadth of reach within agriculture that make [us] uniquely positioned to deliver solutions which drive value and profit for a wide range of businesses. (OB2-WCS website)

The new broker envisaged leveraging their database of 75,000 farms across the UK and Ireland to create a pipeline of private credit providers in a strategic partnership with the Environment Bank. Echoing the happenstance arrangements discussed in chapter 4 in the early days of mitigation and species banking in the US, the individual (OB2.1-WCS) acting as head of business development at the consultancy 'happened to fall into conversation' with the Environment Bank at the end of 2013. A 'mutual contact' at Natural England had made the introduction between the two parties. OB1.2 told me:

> We wanted to look at what we could say that was happening on farms that was more constructive, so these brands had something to 'say'. So, in terms of looking at what other people were saying about 'how you value habitat etc.' that got us involved in the Environment Bank, and they had all the mechanisms and packages and ways of going about it. (OB2.1 020315).

The drive for brands to say something 'green' was strategically aligned with, and incorporated the language from the DEFRA White Paper about 'valuing habitat'. The potency of the 'valuation' narrative here is unambiguous. BDO and habitat banking were being brought to life through moments of chance, coincidence, and crucially, carried by new allegiances kindled through professional networks.

And yet, even with a data facility comprising thousands of farms, identifying landowners with the correct legal and management capacities to act as offset providers was still proving problematic. OB2.1-WCS found that it was frequently too complicated, expensive and time consuming to identify and work with landowners as providers for individual offsets as and when they come through the planning system (OB2.1-WCS 020315). This is

in part because of the legal requirements required to qualify landowners and farmers as eligible offset providers. OB2.1 used a screening system to eliminate farms that did not have security of tenure for at least 30 years or a clear succession plan. These administrative requirements led OB2.1-WCS (020315) to the view that preparing receptor sites on a case-by-case basis was simply 'not worth the hassle'.

Efficiencies and pragmatism were therefore pushing OB2.1-WCS during 2014, towards establishing relationships with fewer but larger landowners. The goal was to develop habitat-banking sites that could provide the credits for multiple offsets, associated with a collection of developments over a longer period of time. The ideal, they reported, would be five or so large farms of a minimum of 40 ha within the county boundaries (OB2.1-WCS 020315)[22]. The proposed budget for each habitat bank would be a potential supply of 240 credits over a three year period. Over the course of this timeframe OB2.2 would work to establish the next batch of landowners to bring in habitat banks 'six, seven, eight' so that the pipeline of credits was ready to go, 'there on the shelf' (OB2.2-WCS 080116). OB2.1-WCS (020315) mentioned that in respect to landowners, they had a 'long list and short list, and there is enough there to give us confidence we can fill the demand for some time to come'. Towards the end of the fieldwork research period, OB2.1-WCS achieved what they believed to be the 'first commercial offset in England'. Although the offset was considered small at 'just five or six credits' across 1 ha of land, the potential at this particular habitat bank was expected to be able to provide up to 400 credits over 80 ha of land (OB2.1-WCS 080116).

As well as streamlining the administrative efficiencies of securing landowners, OB2.1-WCS were under pressure to arrange things so that the whole exercise was commercially worthwhile for their own organisation as well as being financially attractive to landowners. For example in relation to the first point, OB2.1-WCS were anxious to see whether brokering biodiversity offsets through private habitat banks could become the core part of their business model.

[22] The extent to which this either contradicts or complements Lawton principles of 'Making Space for Nature' (Lawton et al. 2010) warrants further research. The Lawton Review of England's wildlife sites and ecological network emphasised that the future of conservation in England must prioritise habitat connectivity and *strategic allocation* of habitats in the landscape. These sites may or may not happen to align with the economic and market priorities and practicalities of finding appropriate farms for habitat banks.

> 'We do believe that it will happen it will just take time for it to happen and the big question is will we still be at the table when it will happen? It's taken a lot longer than we expected, we have put quite a bit of resource into it, we see quite a big business opportunity in it should it come about and think it's worth still sticking with it.' (OB2.1-WCS 020116)

OB2.1-WCS was enthusiastic to prove the concept in Warwickshire first and then roll out habitat banking nationally. Indeed, OB2.1-WCS's job title was subsequently changed from Business Development Manager to Operations Manager for Environmental Services. Part of this wider market research and preparation entailed undertaking 'supply and demand mapping' of potential biodiversity debits and credits across the UK and Ireland. Finding and commissioning landowners to act as habitat banks was something that OB2-WCS claims, as an organisation, they had become 'reasonably good at'. To leverage their existing database asset, OB2.1-WCS had started to show these credit/land supply maps to other LPAs in surrounding counties to encourage them to follow Warwickshire's lead. OB2.1-WCS hoped LPAs would assess the potential demand for biodiversity unit compensation over a period of time using forecasts of development and spatial biological record data as WCC had done. Only then, would Ob2.1-WCS be able to calculate the size, type, location and variety of habitat banks required for the provision of units in other counties.

It was envisaged that Natural England would be able to assist in this market making process. The Environment Bank invited Natural England's CEO, James Cross to visit and walk around the first commercial offset mentioned above, at the end of 2015. Cross confirmed that he was 'on board and happy to help where he could' (OB2.2-WCS 080116). A forthcoming letter from Natural England to LPAs across England was expected to subsequently make 'conversations with various authorities a lot easier' (OB2.1- WCS 080116).

OB2.1 and OB2.2-WCS were conscious that to successfully bring private landowners on board they would need to make it financially attractive to them, and thus economies of scale are further underlined, such that:

> In order to provide the developer with a reasonable cost of credit, and something that is interesting enough to the landowner to do all the thinking and legal and all of that stuff, it has to be a fair size site…. (OB2.1-WCS 010316)

This facet was reflected in the official evaluation report (Baker et al. 2014a) which noted that based on WCS data, an offset generating less than £5,000 per annum (a total of £150,000 over 30 years without adjusting for inflation) would not be economically worthwhile for the provider.

However, farmers and landowners also exhibited a patchwork of motivations for embarking on a habitat banking business and securing land against this for 30 years or more, the brokers told me that:

> We are finding there is a great deal of difference within and amongst the commercial farmers as well. We've got one who owns 400 hectares or whatever it might be but he's more of a business-man than a farmer as he's got several commercial enterprises outside of farming like pharmaceuticals and things like that so he has some very different ways of thinking about it to some of the other landowners we are working with. Some of the other landowners have been on that land for four generations and are now looking at securing it as a nice piece of Shropshire countryside. (OB2.1-WCS 010316)

Intuitively one might expect that a higher number of habitat banks distributed across the county would be favoured for ecological connectivity (and accessibility) over fewer, larger concentrated banks. Indeed, where OB2.1-WCS noted that WCC would ideally like at least ten habitat banks, the realities of delivering these in accordance with requisite economies of scale for the operational and market needs described above, means that they are only looking at 'somewhere between three and eight' (OB2.1-WCS 010316). The concentration of offset units in habitat banks thus indicates that BDO will become a conservation practice that is spatially uneven and further exacerbates separation between society and spaces for nature (Apostolopoulou 2016, Apostolopoulou and Adams 2015). Furthermore, there are class and social equity implications to these trajectories of spatial distribution of lost and gained wildlife sites under habitat banking. These implications point towards the consolidation of and capturing of the biodiversity as well as financial value by large landowners and perversely, at the expense of biodiversity impacts and urbanisation elsewhere. Once again, the market efficiencies dictating the need for fewer but large habitat bank sites - rather than democratic or conservation ideals will shape the direction and character of the conservation and social outcomes into the future.

Blending BDO markets with farming business models

The turn towards habitat banking with farmers drew on economies of scale by grouping strategically situated habitat locations. It was also expected that large commercial landowners would be more economically astute and therefore able to supply competitively priced offset credits to form the basis of a developing a market (OB1-WCS 020315). It was this combination of commercial outlook; farming experience and habitat management that makes the corporate broker partnering with the county council confident that with this approach they can produce a 'good biodiversity yield per hectare' (OB1-WCS 020315).

The biodiversity productivity 'yield' will determine how large the banks will need to be since highly 'productive' land would require fewer hectares to produce the equivalent number of biodiversity units. The habitat bank offering the first commercial offset noted above, offered 'yields' of an around five units (credits) per hectare. However, OB2.1-WCS believes that fifteen units/ha is possible in some circumstances. A 'good' biodiversity yield would see a single hectare bear ten units and a 'poor' one only two or three. Therefore land with a low biodiversity baseline offers the greatest scope for 'value' improvements and is thus financially superior since it can yield the greatest biodiversity 'return on investment'. It is no coincidence that the vocabulary here is shifting towards agricultural economics since this frame constitutes the calculative logic through which OB2-WCS are establishing the habitat banks in Warwickshire. OB2.1-WCS proposes there is an important difference to providing offsets in a commercial agricultural context rather than through a conservation NGO:

> We are commercial operation managers that understand farmers, not a bunch of hippies that want to turn it into a wildlife park…[BDO] has been advertised from eco companies not with a farming spin and they talk a different language…I think a handful of offsets have been written with NGOs. So, when the farmers look at it they think about delivering the objectives of the Wildlife Trusts on common land rather than meeting the needs for their farms and the farming communities. (OB2.1-WCS 010315)

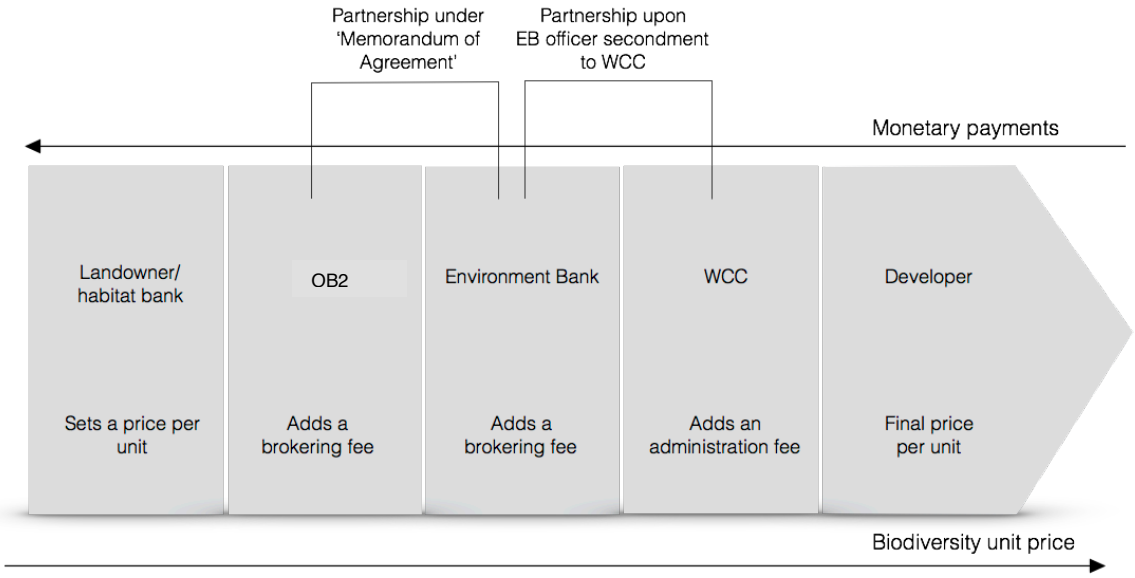
OB2.1-WCS suggests it is the 'unique value' they bring as brokers not only through the valuable database of farmers and landowners but also through their expertise and commercial farming nous. Brokers act as 'translators' for the location and extraction of value through turning otherwise unproductive parcels of land into productive ones (Tsing 2015). OB2.1-WCS told me:

> There are various things that have to come together to get a really high credit yield but if you know what you are looking for then you can pick the right piece of land with the right plan and create much more credits than you would otherwise. So I think and our view is what our competitive advantage should be, should this take off, is that actually we're quite good at that. We can provide an attractive payment to the farmer and still deliver a developer with an attractive credit price. (OB2.1-WCS 010316)

The biodiversity value chain

To summarise, the landowner sells biodiversity value by the hectare and receives a yearly rent for the service. The developer purchases biodiversity compensation by the unit in a one off down payment, which the Environment Bank administers as initial brokers and intermediaries of the deal. The Environment Bank's fee is kept in a secure client account rather than being subsumed into a bigger pool of capital. The interest that accrues on the initial offset down payment (which could be anywhere between tens to hundreds of thousands of pounds) would be put into an insurance scheme in the event that the offset work does not achieve the proposed habitat conditions and therefore credit values (OB1-WCS 241114). It was not clear how much of every transaction OB2-WCS takes or how this additional 'middle man' fits in with the Environment Bank's business model. Echoing the spatial/ unit value conversion illustrated through the commensurating properties of the BIA in the contract above, a translation process must occur through the value chain between landowner and developer. Much like assigning football pitches as polyvalent repositories for different fields of value, the spatial size of offset sites determines the value that landowners can extract in BDO markets. Conversely, the developer may have no interest in the size of the spatial area of the offset area or habitat bank they are buying from. The economics of BDO means developers will simply seek credits that reflect the 'best value for money'. OB2.1-WCS is mindful of the need to pay landowners according to hectares 'tied up', which they propose encourages the farmer to concentrate or intensify biodiversity yield per hectare to maximise return from finite land. Figure 12 illustrates the biodiversity value chain through the habitat bank model.

Figure 12 Warwickshire's habitat banking value chain



The production (farming) of biodiversity units cannot yet compete economically with agricultural commodities. Biodiversity offsetting and associated habitat banking is not in a position where this can spatially displace food production, nor would it likely be politically expedient for it do so. OB2.1-WCS (051116) reported that they are 'working with farmers to use their difficult to farm pieces of land - we are not looking for good quality high yielding, grassland or certainly not arable land'. The brokers use their commercial agricultural expertise to select the margins of otherwise productive farms, which might comprise 'lower agricultural value land, that is more slopey, difficult to farm, lower yield etc.' but where farmers still wish to 'drive an income from that bit of land' (OB2.1-WCS 050116). Under offsetting, landowners, with the assistance of brokers and intermediaries are able to convert marginally productive agricultural land towards economic uses within an emergent market for biodiversity units[23]. OB2-WCS is pleased

[23] BDO is not compatible with Higher Level Stewardship (HLS) at the moment because HLS is geared towards species-specific enhancements rather than habitat management. Nevertheless, OB2.1-WCS anticipated that in the long run farmers will be able to access a blend of HLS and BDO funding on the same land. The future of EU Stewardship scheme funding such as HLS and Entry Level Stewardship (ELS) under the Common Agricultural Policy (CAP) payments in relation to economic valuation of biodiversity warrants further research. This point is made even more pronounced due to the EU exit referendum result in June 2016 and the uncertainty over the future of farming and environmental subsidies beyond 2020. Advocates for natural capital approaches are discussing reform of the subsidy system and exploring whether markets in environmental services could take over from Government's commitments

to establish this new commercial channel for landowners through an emerging biodiversity market, in part because they are able to extract value from the transactions. But perhaps without due concern and significant interest, the foundations are being laid for biodiversity within habitat banks to be 'harvested' or farmed according to growth narratives of economic agricultural discourse. Brokers here create new economic value in two senses. OB2-WCS are leveraging their own business assets through extracting new value from their databases of farms as well as securing value from marginal agricultural lands they are soliciting to become enrolled within these new market assemblages.

5.8 Discussion

Making biodiversity values through BDO demands that many things converge simultaneously (Li 2014). Warwickshire's actants, as we will come to see in comparison with the other case studies, were unusually strong and combined to enact BDO in practice. Whether BDO gains traction and how it takes shape at local government level is therefore thoroughly contingent on the character and nature of alignments between these actants. In this case study, we encountered:

- A large, financially independent, entrepreneurial and motivated ecology department at county council level,
- A close working relationship with district councils,
- Exceptional biological data records and cartographic devices with associated biodiversity spatial strategies,
- An in house Environment Bank biodiversity 'offset broker'.

As a consequence of these factors we also saw the rapid re-scaling of NNL into local policy to provide a 'carrot shaped stick' as the enabling policy environment for BDO. The availability of a government endorsed calculative device like the DEFRA metric simply made things easier for Warwickshire to become what they referred to as a 'bottom up' pilot site. Nevertheless, even with this unique combination of elements in place, there was friction (Tsing 2005) in actively assembling the values of Warwickshire's biodiversity. Despite the growing demand for biodiversity units as compensation for losses there was no easy way of matching these debits with credits from offset suppliers. The metric was used on numerous sites subject to development application. Biodiversity

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to match EU agricultural subsidies until 2020, which currently constitute annual payments of £3.2b to British landowners (Helm 2017).

losses (as negative values) were being accounted for and made visible to planners. Occasionally these were being translated into financial sums and payments to the county council through section 106 (s106) agreements[24] if offset providers were not secured. But the market was not simply there waiting to happen. Elusive landowners, burdensome administrative and legal frameworks and the pragmatics of building a market infrastructure all prohibited the easy assembling of BDO frameworks.

Such frictions were partly attributable to the immaturity of BDO and the challenges associated with translating the old ways of addressing biodiversity issues under planning to a new one. Translations included, for example, the need to upgrade the professional ecological survey methods, to bring people along on the journey, to construct new frameworks and devices for envisioning nature - new ways of framing and acting upon biodiversity (Apostolopoulou and Adams 2017). Other translations involved conversions to data units that made biodiversity amenable to being processed through BDO's calculative methodologies (I return to the processes of commensuration below). The most important actors performing these translations in Warwickshire were the brokers. Brokers acted to smooth and align different elements. The Environment Bank was the first on the scene but as they encountered friction, they enrolled new brokers. Biodiversity brokers helped to translate previously economically sterile land into newly productive uses in line with an emergent market in biodiversity 'production', that they were themselves, active in creating. Brokers also translated these new biodiversity values from the offset providers to the buyers in the market along the BDO value chain (Figure 12). I return to the importance of brokers and other intermediaries in chapter 8.

Whether or not BDO would in fact deliver a 'no net loss of biodiversity' the metric was already having important effects on biodiversity considerations within planning processes. Local authority and NGO ecologists revealed that application of the BIA frequently produced biodiversity values (as numbers) that would simply have been overlooked in planning decisions prior to this new legibility. Deploying the metric was saying new things about habitats through the production of hard numbers, which the old system did not have the language for. Sometimes these numerical representations of loss empowered planners to demand more mitigation work from developers in their plans, or even refuse applications entirely (LPA2-WCS 300714). These are important material effects, which highlight some contextual utility of a new calculative technology.

[24] Section 106 agreements outline planning conditions set by the LPA that the developer must observe and were being used as a means of collecting the BDO offset payments.

Still, there are other longer-term implications to these translations. Whether or not BDO shows signs of fulfilling aspirations for the no net loss of biodiversity, it is worth reflecting on the wider shifts to conservation practice that it may be engendering in this county. Indeed, it is perhaps *because* Warwickshire had such a strong array of elements - almost perfect institutional and technical arrangements for BDO, that it makes it such a potent case study to explore. I identify four key shifts to conservation practice in particular.

1. Values that people struggle over

This case study makes apparent that the model of BDO is envisaged to produce a neutral calculative framework, but in fact it creates new things that people struggle over. The metric (as a calculative device) for deciding biodiversity values at development and receptor sites was generating numerical values that were subsequently negotiated and adjusted. Instead of being an impartial and objective calculation, the new metrics associated with BDO were used in creative ways, as users attempted to strike the right balance of values. As predicted in theory (Walker et al. 2009), and observed in empirical accounts of BDO elsewhere (Sullivan 2013), it is noticeable that the nexus of competing development, conservation and LPA interests can mean that biodiversity values calculated through the metric are adjusted downwards so as to facilitate cheaper compensation for developers. This seems consistent with the Coalition Government's political commitments to house-builders and developers set out in the Conservative Manifesto, which I discussed in chapter 4, and with the emphasis on market values for conservation more generally. Concealed within these technical processes are additional value judgments and also struggles to arrive at the perceived 'right' numerical values in the end. What this empirical case has shown therefore, is that through the application of a calculative device, biodiversity and economic values are being negotiated. The valuation outcomes are adjusted such that they can straddle competing value systems and simultaneously be presented as being economically palatable, politically pragmatic *as well as* ecologically coherent. It is likely that more often than not, the latter may easily be subjugated to the influence of the prior two dimensions. In so doing, this case illustrates that BDO will likely simply reflect or entrench rather than overturn prior configurations of power and influence in the English planning system.

2. Commensuration

Second, the case history provides empirical material to illustrate the working in practice of commensuration processes that arise, as different habitats are made equivalent

through the application of BDO metrics. Numerical signifiers form proxies for qualitative, ecological assemblages, calculated with the aid of the DEFRA biodiversity metric, as represented by the BIA Excel spread sheet formulae presented in this chapter (Table 7 and Figure 10). Sometimes these commensuration processes generate unintuitive outcomes (Pawliczek and Sullivan 2011). For example, in this case it is unclear how exactly a sports pitch can mature to become a biodiversity habitat, or if sports pitches can really be said to be maintaining 6.36 units of biodiversity value at the development site, compared with, say, the 6.36 units of high quality grassland habitat supporting a range of BAP species proposed at the offset site. The proposed mitigation value provided through sports pitches, measured as habitats of low distinctiveness and poor condition is achieved principally through acting as the largest 'habitat type' within the development and thus illustrates the function of numerical abstractions to commensurate distinct biota through making them interchangeable (Sullivan 2013, Carver 2015) (see Figure 11).

Not only have different habitat 'types' been made equivalent but different sizes of habitat appear equivalent in terms of biodiversity 'value'. The act of constructing biodiversity unit values constitutes the translation of nature or representations of nature i.e. qualitative and quantitative ecological data into a universal and accepted unit as a surrogate, such that it is commensurable and comparable along a uniform scale. The resultant values are flat in the sense that they appear on a continuous plane; they are interchangeable. The abstraction to units unshackles representations of material natures from their geographic, temporal or qualitative specificity. BDO functions by creating a flat ontology of nature. This idea echoes the discussion I outlined in chapter 2 in respect to the making of biodiversity according to unit measurements, whether those are species or habitat categories or numbers in databases. Units act as a prelude to their commodification under BDO (Turnhout et al. 2011, Fredriksen 2017). In my case study, multiple fields of value have been collapsed into a single material football field. An *actual* football field is classed as both a qualitative habitat type *and* a numerical biodiversity value. The football field straddles different categories of value across spatial area, habitat type and biodiversity unit score, offering a different *value* field within each. The exchange of value between sites of loss and gain is facilitated by the ways in which these different value fields; spatial, habitat and biodiversity flow and collapse into one another through functionally and spatially abstracted numerical proxies (Robertson 2000, Castree 2003). This underpins the exchangeability of different values that are subsumed and obscured within quantitative continuums (in this case, a sports pitch).

The reduction, across divergent, heterogeneous objects to one fluid unit scale makes the idea of net gains and losses of biodiversity coherent. Indeed, the conjuring of a comparative relational quality between unrelated entities permeates the rationale and appeal of BDO in policy circles, and underlines the central idea that the approach can reconcile development with conservation through the replacement of the loss of X with creation of Y. The idea of 'reconciliation', leads me to my third observation for the practices of BDO in Warwickshire, where the calculative approach towards biodiversity is facilitated and enabled through a spatial grid of field-scale habitat data. Biodiversity offsetting in Warwickshire is being mobilised as a way of actively optimising the *placing* of nature and infrastructural development across the county. In this respect, I consider BDO to be constituted by a drive for spatial rationalisation between different users of land, i.e. across development, farming and biodiversity conservation.

3. Spatial rationalisation

Land use demands in Warwickshire are reflected through struggles over space. The case study also shows that biodiversity loss too, is framed as a spatial problem. To rationalise space would mean making it manageable and ordered - to deploy reason, logic and modern technical values. According to the Oxford English Dictionary (2017c), to 'rationalise' is also to justify - to make clear the reasons behind something. Technical values therefore help perform rationalisation as justification, since they neutralise the politics of such decision-making processes. Li (2007a) refers to this de-politicising process as 'rendering technical', since numbers 'justify' (Porter 1995). The fabrication of uniform units of nature provides the mathematical building blocks of this endeavour.

By deploying an analytical lens of assemblage, I have accentuated the role of devices as actants in performing biodiversity values. Where the previous two discussion points emphasised the role of the DEFRA metric as the calculative device, my third relates to the role of the WCC's Habitat Biodiversity Audit (HBA) and associated inscription devices of databases (both of biological records and also potential credit supplying landowners), maps and spatial technologies. The HBA is important to the production of value as it acts as a spatialised grid that interacts with the BIA (through determining the application of space based exchange rules). For example, the HBA determines how geographically specific habitats are valued or devalued according to their location and proximity to its 'priority areas'. The HBA, like the other devices is a technology of spatial management. The pixelated grid of data as spatial representations of graded habitats thereby informs Local Plan making through land allocation as well as the strategic

placement of biodiversity offsets (in so far as these are compatible with the other legal, commercial and practical requirements shaping the placement of private habitat banks).

I emphasised the role that the DEFRA metric plays as a calculative device to facilitate commensuration across divergent fields of value in the preparation for its commodification. Sometimes the valuation of biodiversity amounts only to translating emplaced ecologies into universal 'biodiversity units' amenable to being exchanged and does not necessarily entail full monetary pricing and exchange. These processes have therefore less to do with direct capital accumulation from the growth of biodiversity markets, where actors are able to capture relative surplus values (even if this is becoming more likely as BDO shifts gear towards habitat banking and potential revenues emerge for landowners). In other words, BDO, while partly about making money for some actors, is as much if not more to do with what Foucault (1977) labels, creating 'docile minds and bodies' - of making land and nature compliant with the spatial demands of economic growth vis a vis, infrastructural development. Biodiversity offsetting introduces a geographic and temporal flexibility to the spatial frictions of conservation in a landscape where there is a competition across different uses; residential and infrastructural development, pastoral and livestock farming, wildlife and so called 'natural' landscapes. The following case study provides further empirical content in relation to this final point.

In chapter 2, I discussed how the fetishised principles of efficiency and flexibility underscored the emergence of aggregate rules and exchangeability in the 1970s. Aggregate rules and NNL were deliberately conceived to offer compatibility with commercial logics and neoliberal economic ideology. This avowed intention of aggregate rules and accounting based frameworks is just as relevant to BDO in England today. To put it simply, BDO is first and foremost about 'making space for development' even while it is primarily framed as 'making space for nature' (Lawton et al. 2010).

Spatial technologies were also mobilised to assist actors in building a market in the absence of forthcoming receptor sites. Using 'supply and demand mapping' and farmer/ landowner databases, OB2.1 and 2.2-WCS acted as translators, working to convert economically marginal spaces into productive ones through creating 'yields of biodiversity'. Anna Tsing (2015) uses the expression 'salvage capitalism' to account for the generative process that seeks to creatively incorporate the 'margins' or the 'edges' of non-capitalist values and entities into capitalist value and characterises these as value 'translations'. As well as contesting the seemingly misplaced positive inflection to this term, Sullivan (2017b) questions whether 'salvage' is a useful amelioration to Marx's

concept of primitive accumulation, as Tsing so intends. Whether salvage capitalism or primitive accumulation, this example illustrates how BDO shapes the conversion of *actually existing* (field) margins as the productive frontiers of agricultural value making into new sources of rent in the form of habitat banks.

4. Value for money and the production of a good yield per hectare

Space and scale matter to value making and the functioning of markets as this case study illustrated. Actors were searching for economies of scale in habitat provision so that BDO could establish itself according to market efficiency logics. High transaction costs from receptor site identification, preparation and legal fees were encouraging the combination of fostering economies of scale by grouping strategically situated habitat locations with the economically astute ways that large commercial landowners can manage their farms (OB2.1-WCS 020315). This was expected to result in a good supply of offset credits from newly formed 'habitat banks' that can underscore the basis of developing a market. Due to these pressures and because of the expertise of the actors engaged, BDO is becoming further aligned with commercial agricultural productivity agendas that emphasise efficiencies and scale of production through concepts of 'yield'. Thus, my final discussion point related to this this case study indicates that the pressure of creating 'value for money' in compensation strategies for conservation may be pushing BDO in particular directions that favour the growth of market values and exchanges for offset units (Hannis and Sullivan 2012; Dauguet 2015) with implications for biodiversity conservation in practice.

This chapter has introduced some of the political implications for the trajectories of habitat banking under BDO. Where others have pointed out the potential for spatially and socially uneven outcomes of BDO (Apostolopoulou and Adams 2015, Apostolopoulou 2016,), this case study has provided empirical evidence for the ways that habitat banking, as an extension to BDO arrangements, is actually fulfilling this expectation. I described the spatially uneven and unequal distribution of the placements of biodiversity habitats as bank sites, and the parallel capture of financial rental streams from this process. The fact that both of these benefits will flow to certain actors on account of their existing large landholdings as asset bases and at the expense of disappearing biodiversity habitats elsewhere seems politically and morally perverse. Furthermore, these arrangements point towards the exclusion of traditional non-private conservation actors such as conservation NGOs. The need for large consolidated land holdings to provide an economy of scale in habitat banking is something that NGOs typically cannot bring to the table. As such, the empirical evidence presented within this

chapter indicates that BDO and its market requirement for habitat banking is a system that will drive conservation towards a concentrated smaller number of large private protected areas, while simultaneously being development led (Pawliczek and Sullivan 2011).

Consideration of the broader implications for the political economy of land subject to biodiversity offsetting and theories of value making are an apt place to bring this chapter to a close. This is a theme that reappears in the next case study example based on the South Devon pilot site of the DEFRA study, and one that I expand in the final discussion and conclusion. The following chapter highlights a range of sometimes overlapping themes resembling this chapter's but also illuminates interesting differences. The divergences further expand our understanding of the empirical nuances of practicing BDO. In particular it illustrates the emergence of 'hybrid' arrangements as the BDO assemblage collides with other extant conservation assemblages oriented around certain flagship species. Species units present a problem for BDO as detailed in chapter 4, the DEFRA metric was not designed to 'see' them.

CHAPTER 6
RE-ASSEMBLING AT THE LOCAL FRONTIER: BIODIVERSITY OFFSETTING IN SOUTH DEVON

6.1 Introduction and chapter outline

Exploring the situated practices of BDO in South Devon provides further clarity over how biodiversity values are made in practice. This chapter follows the structural format of the prior case study in that it starts by exploring the professional, political and institutional context of the pilot site and the ways in which these factors shaped how BDO was enacted and unfolded.

After setting the scene of the case study, I present the detailed BDO processes pertaining to the compensation requirements for a residential development for 255 houses. This case study examines the ways in which BDO came to serve a specific function for planners faced with intractable conflicts. Planners faced struggles associated with the pressure to deliver more houses in a challenging landscape topography and few other options for placing the development. In this sense, I illustrate the ways in which BDO was imbricated with contradictory demands on finite space, planning time frames and developer budgetary allocations. For example, I highlight how BDO is generally expected by its advocates to 'transcend trade-offs' (ten Kate et al. 2004) within development, but in fact opens up additional and unforeseen value conflicts. The example shows how BDO came to be framed by the developers as an option that the LPA could enforce at the expense of complying with minimum quotas for provision of affordable housing.

The chapter travels to various locations and moments wherein the biodiversity offset contract in South Devon played out. One of these locales was the planning appeal committee meeting in the district council offices in July 2014 where BDO was discussed in the context of objections to the ecological impacts of the development. In methodological similarity to the prior chapter, this case study also charts the development of various adjustments to the scoring practices during the negotiations between planners and consultant ecologists over biodiversity impact and mitigation values.

The chapter then turns to examine the geographical specificities that shape the making of a BDO hybrid. I have referred to this process as a hybridisation since prior conservation policy assemblages, such as the importance of conservation of flagship

species and other additional compensation frameworks determine both the nature of value units produced as well as the compensation arrangements that were undertaken.

In summary the chapter highlights five overall themes that the case study illuminates. These findings relate to the incongruities and disjuncture between the idealised rhetoric of BDO as a means of delivering standardised biodiversity values and the situated enactments of the policy. The discussion explores the practical ways in which actors tinkered with DEFRA's guidelines to translate value between different ecological units (habitats and species). It also discusses the institutional dynamics shaping how BDO was being enacted. Such dynamics included commercial conflicts of interest and the neoliberal ideology permeating English development policy and planning (discussed in chapter 4). As an enduring theme throughout all of the case studies, this chapter also illustrates how the impact and mitigation valuations were precarious constructions, whose instability was concealed through the potency of finalised numerical inscriptions in documents. The resultant numbers were thus imbued with political agency that enabled planners to neutralise civil society opposition to the development. Finally, as already indicated, the final part of the chapter opens up a discussion over the relationship between biodiversity values and land values.

6.2 Case study context: BDO at the district council

In contrast to the strong cohort of influential well-resourced individuals and policy foundations that enabled BDO to gain traction in Warwickshire, aligning these factors in Devon was more of a patchwork exercise. South Devon formed one leg of the three-part sub-pilot approach, also comprising North and East Devon. The three Devon district councils were independent from each other, but where there were overlaps, South Devon was proactive in moving things forward. Like the other LPA sites within the overall pilot, Devon had struggled to establish progress at trialling BDO due to financial, staff and time capacity limitations. BDO was slow coming - it was only starting to penetrate the wider planning processes at the county and district council towards the close of the pilot study in spring 2014. The experience these actors did manage to achieve was more or less related to the persistence of one individual working largely in their lunch break. As a researcher, I was given the impression that apart from this individual, who was the Green Infrastructure Officer and pilot lead for South Devon (denoted here as LPA1-SD), the two biodiversity officers comprising the district council's ecology team (LPA2-SD, LPA3-SD) were not engaged with the trial. LPA1-SD was referred to as the 'expert working on it' (LPA2-SD 25016) - the others didn't feel they had much to add to my research. LPA1-SD's efforts to identify suitable development applications on which to try

BDO with willing developers and not already entangled with other conservation designations incompatible with BDO, appeared therefore to be somewhat of a solitary struggle.

This uncoordinated effort was largely why the BDO strategy and associated policy frameworks had not emerged during the two year window. Where Warwickshire was able to fall back on certain policy positions to encourage developers to use the metric, in South Devon the slow coming of a county wide or systematic approach backed up with policy had 'stalled things' (LPA2.3 150216). The District Council Local Plan 2013-2033 mentions BDO, which is considered to form some function as a 'black and white part of policy' (LPA1-SD 270115). It also refers to goals for a 'net gain' of biodiversity under its policy 'EN8'. Furthermore LPA1-SD (270215) told me he had managed to 'sneak' a paragraph on BDO into the South West Exeter Development Framework (2014) under a heading on 'other guiding principles' for biodiversity concerns that reads:

> It is expected that SWE1 will achieve a net gain for biodiversity in line with Policies EN8 and EN9. Assessments of loss and gain should be carried out to recommended methodologies, such as the Defra biodiversity offsetting metric. Where the development will result in unavoidable habitat loss, compensation and enhancement will be required. This can be achieved as part of onsite green space provision, through the restoration and creation of habitats, for example cirl buntings. Where onsite measures are insufficient to achieve a net gain, offsite measures may be required. (South West Exeter Development Framework 2014: 21)

It took a further year and a half for the pilot site to produce a biodiversity offset Local Strategy and Guidance document that included a spatial strategy for offset provisions. As well as the lack of policy and organisational alignment, South Devon also had a unique combination of barriers that made the translation from normal planning processes to BDO arrangements as described in chapter 5, especially difficult. These frictions included various difficulties in applying the DEFRA metric and devising offsetting around existing statutory conservation designations associated with Special Areas of Conservation SACs under the EU Habitat's Directive and the county's 'flagship species' conservation priorities.

In respect to other conservation priorities associated with the EU Habitats Directive, BDO came to clash with a different conservation compensation framework levelled on developers in the form of 'suitable alternative natural green space' (SANGS). Natural

England requires LPAs to solicit financial compensation for the provision of SANGS as a form of statutory mitigation to account for the increased number of residential properties leading to recreational impacts on nearby SACs and Special Protection Areas (SPAs). SANGS is delivered through the Community Infrastructure Levy (CIL) mechanism and typically calculated as a £350 contribution per dwelling. Due to its connection to European Union Habitats Regulations, which are statutory conservation requirements, this form of compensation is prioritised over the generally unprotected habitats DEFRA specified as 'offsettable' in their BDO guidelines. LPA1-SD (290714) told me that guidance to achieve the 'no net loss' of habitats recognised by the UK BAP 'is just policy', rather than a legal directive.

The detailed examination of efforts to use the metric and negotiate biodiversity compensation for a residential development illustrates some of the ways in which BDO in South Devon adapted to and converged with other existing conservation assemblages. An additional barrier emerged from the importance of cirl buntings (*Emberiza cirlus)* as conservation priorities. Cirl buntings are 'a scarce and localised breeding bird in the UK, confined almost entirely to South Devon' (Baker et al. 2014b). They are protected under the EU Directive on the Conservation of Wild Birds 79/409/EEC, under Part 1 of the UK Wildlife and Countryside Act 1981. Due to the RSPB's programme of work in South Devon, cirl bunting considerations were incorporated into the heart of the local offsetting approach, even though DEFRA's design is based on the measurement and valuation of habitats, rather than species. The following extract is taken from the South Devon BDO Guidance:

> Cirl Buntings favour an extensively managed mosaic of mixed farmland, with fields typically of 2ha and smaller. They nest in dense cover provided by particularly thick hedgerows or scrub, typically foraging within 250m of the nest in summer and rarely more than 2km in winter. In the summer months they rely on unimproved or rough grassland and field margins for the invertebrates, particularly grasshoppers and bush-crickets, needed to feed growing chicks. In the winter and spring they feed on small seeds favouring spring-sown cereal crops, particularly barley, and weedy over-winter stubbles. Offset design should ensure a suitable mix of these summer and winter foraging and nesting habitats, taking into account the local context. (South Devon Biodiversity Offsetting Guidance, October 2014: 31)

These existing conservation frameworks came to bear on how BDO processes could value habitats lost through the development. It is to the detailed contract negotiation that I will now turn.

6.3 Attempts to enact a biodiversity offset in practice

The development site

The BDO agreement outlined below relates to efforts to secure biodiversity compensation requirements for the habitat loss associated with a planning application to build 255 houses. The proposed site is located on a steeply sloping, ten hectare parcel of land situated on a green crest at the north-western fringe of Teignmouth in South Devon. Teignmouth is the second largest town in the district with a population of 15,300 and growing demographic pressures from in-migration (Teignmouth Local Plan 2013-2033). It is a coastal town with a cherished undulating rural green belt hinterland. While the topography is celebrated for its natural beauty, it presents a severe restriction to expanding urban fringe development and construction. The town is also adjacent to the north bank of the river Teign, which limits residential expansion opportunities further in-land, to the north and west. These landscape features meant that it was becoming increasingly difficult for planners to allocate housing development sites in practical locations.

As well as being amenable to the pragmatics of actual construction, proposed sites would need to balance a range of other features. For example, developments are typically subject to an assortment of ancillary planning values and conditionalties through s106 agreements, such as the provision of affordable transport infrastructure, education facilities and minimum quotas for affordable housing targets, not to mention the spatial overlaps with buffer zones of the SAC and SPAs. All of these factors were required to align with the commercial 'viability assessments' set by the developers, which were thought to to be a 20 per cent profit margin (LPA1-SD 150714) but in reality are entirely arbitrary and lacking transparency for the LPA (NGO1 280116). The emphasis on developers' viability assessments is a central theme throughout this case study. This nexus of competing social, ecological and economic values and interests dramatically shaped the way that BDO unfolded as it hybridised with other assemblages already animated in this setting. The development site, although heavily contested by the local population, was relatively uncontroversial from a planning perspective. The site had been considered as part of the Strategic Housing Land Availability Assessment (2009)

and allocated in the District Council's Local Plan for 2013- 2033 for 250 houses, of which a minimum of 25 per cent were to be made 'affordable'.

The proposed development site lay at the head of a local nature reserve but was also nearby to other designated sites including one Site of Special Scientific Interest (SSSI) and two special areas of conservation (SACs). One SAC was under a kilometre away and another, ten kilometres away. Therefore the location of this development triggered statutory protection mechanisms associated with a European protected species and SANGS. For this reason, the possible impacts associated with increased recreational users of the SAC formed the primary ecological impact concerns for planning advisors at Natural England.

The development site (shown in Figures 13, 14 and 15) is comprised of a wildflower grassland hay meadow and habitat to a range of invertebrates, made up of small fields flanked by traditional hedgerows and winter corn stubble that provides habitat for cirl buntings that had been using it as a breeding ground. The plans propose a green buffer along the southern edge to protect the amenities of nearby houses and the watercourses of the bordering nature reserve. The development site is ringed to the north by a busy B road and to the west by open fields and hedgerows. To the south-eastern edge, against the outer western threshold of the existing town, lie Frobisher woods, a mixed woodland copse much loved by local residents to which its very own *Facebook* page attests. In the *Facebook* posts, local community members describe varied sightings and soundings of a variety of cherished species of birds, plants and insects such as greater spotted woodpeckers, bullfinches, slow worms and butterflies. The residents also used this facility to celebrate seasonal changes or make observations of particular species individuals. The site, in other words was a treasured green space and biodiversity habitat.

A single breeding pair of cirl buntings was noted during a reptile survey and included within the EIA submitted by the consultant ecologist in February 2014. The RSPB picked up on this since cirl buntings fell under the RSPB's conservation priorities of the region. For this reason, the LPA in dialogue with the RSPB, decided that the compensation for the habitat impacts at this development would deliver a cirl bunting-specific mix of grassland habitat.

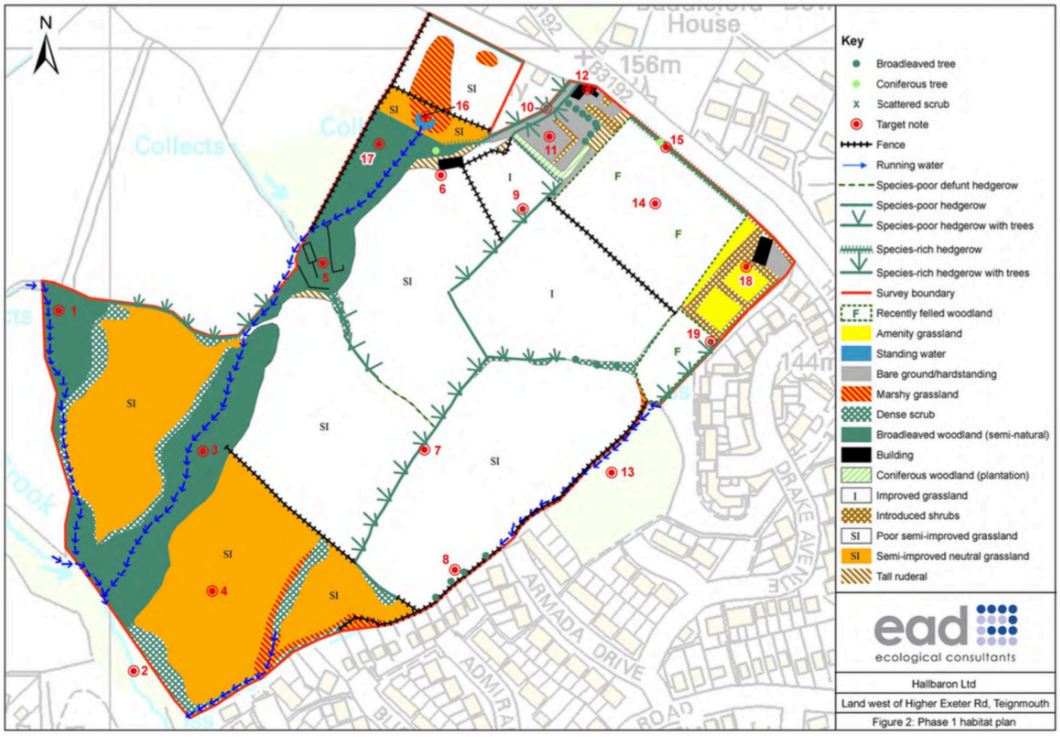
Figure 13 Development site subject to offsetting

Source: From top clockwise, author, author, Consultant Ecologist Ecological Impact Assessment Report

Figure 14 Draft development layout plans

Source: Peter Brett Associates 2014

Figure 15 Baseline habitat mapping and BIA codes



Source: Consultant Ecologist Ecological Impact Assessment Report

The site had been owned and managed since the 1960s by a consortium of house builders called Hallbaron Ltd (PC1-SD 050216). Hallbaron submitted and won the initial outline approval[25] for 255 homes at a public committee meeting in July 2014 following an application rejection and subsequent appeal. Just over a year later, in October 2015, Hallbaron Ltd. sold the land to Devon County Homes to actually build the houses since they had been 'banking' it in preparation for obtaining planning permission (PC1-SD 050216). The landowners thus sold the site for a vastly greater value than it would have had prior to achieving this outline approval. Government guidance (DCLG 2015) around the post-permission value of land for the Teignbridge County provides a sale value estimate of £1,950,000 per hectare. It is therefore reasonable to expect that this sale achieved an extraordinary market value of £19,500,000 for the ten hectare parcel of development land. According to the estimates of agricultural land value used as the basis for BDO compensation costs, the approximate value of agricultural land in the county would be only £8000/ ha (or £80,000 for the ten hectare parcel). The post-permissions value of the development land is approximately 250 times that of land prior to achieving residential planning permission.

The development was subject to an experimental and early attempt within the LPA's BDO pilot study. The s106 agreement stipulating the planning conditions for outline approval included clauses for provisions of general financial sums in compensation for residual biodiversity impacts after the metric had been used. Notably, the total financial sum was left open ended since application submission and award was only for the outline approval. The s106 instead provided a methodology for the calculation of the final amount based on the total number of units that would require compensation. This flexibility was possible since the council would calculate the final figure on a per hectare basis rather than the delivery of biodiversity units. South Devon's BDO guidance stipulated that offset compensation may have to be delivered to specifically benefit cirl buntings. The s106 therefore needed to provide a translation between biodiversity units and cirl bunting hectares, further details of which are provided below. The final unit of measurement therefore was a spatial one, mirroring the species and wetland mitigation banking methods in the US. The concluding BDO conditions would be established when permission for the reserved matters was granted and the development layout was

[25] Outline approval refers to a planning permission on the general principles of how a site can be developed. Further details of layout, scale, appearance of buildings and landscaping of the site are subject to conditions that would require subsequent approval as 'reserved matters'.

finalised to establish final residual losses in terms of biodiversity units. This second planning application now being undertaken by Devon County Homes is presently underway to determine the final layout and designs, where new biodiversity offset calculations will be completed according to the final impacts and residual losses. I trace the layers of negotiation to arrive at this BDO outcome in the sections that follow.

Intractable values: biodiversity offsetting and 'transcending trade-offs'

Biodiversity offsetting was introduced into a relatively complex planning application that was already entangled with a tightly woven nexus of competing value agendas. This nexus consisted of contradictory demands on finite space, time and developer budgetary allocations. The site was considered essential for new houses in Teignmouth but planners were beset with challenges to account for various irreconcilable factors. Officers at the LPA were trying to find a balance between targets to meet 25 per cent quotas of affordable housing, sustainable and affordable transport provision, which did not overly compromise the existing green infrastructure of the site, developer's 'viability assessments' and also complied general habitat impact avoidance and mitigation. BDO as a new calculative framework attributing financial values to biodiversity habitats interacted with these other considerations in unpredictable ways.

The size of the proposed residential development had already been scaled back from 1000 to 255 dwellings due to transport and habitat impact concerns on cirl buntings. Even so, the proposal for the smaller housing development was still extremely unpopular with the local community. The existing residents contested the development on traffic grounds and the destruction of unique and characterful landscape features and resident wildlife. Yet, this location represented the only possible site for residential development in the town, at least, for the time being. In 2012, the development site was one of three major allocations for housing in the town, but the other two were deleted from the submission to the local plan as they were considered 'undeliverable'. The developers in their public board at a consultation in 2013 announced 'TE3 is *the* substantive deliverable residential development for Teignmouth' (emphasis added)

The district council's planning department estimates that the issue of delivering more houses in a difficult landscape topography and geography has simply been postponed until a later date (LPA2-SD 250116). At some point, the LPA would need to produce a supplementary planning document (SPD) as part of a review of the local plan 2013-2033 that was expected to outline the need for more land to be freed up for housing developments (LPA2-SD 250116). The pressure for planners to deliver more housing to

satisfy the quantitative requirements set out in the Strategic Market Housing Assessment (SMHA) meant they were under sustained review by the planning Inspectorate. This external pressure from central government came directly into conflict with the reality of severe physical and economic planning constraints in the landscape. Something had to give.

In so far as BDO offers mobile compatibilities with planning constraints around other valued but non-negotiable features such as topography and transport requirements, it is a spatial solution that can be used to 'smooth' planning tensions (discussed in the previous chapter). For this reason it emerged as a resolution to ameliorate habitat concerns in the context of limited options to adjust other features of the development. In other words, biodiversity impacts are deemed resolvable because they can be moved elsewhere, whereas other problems, intrinsic in the location, cannot. Biodiversity offsetting is useful for planners precisely because it abstracts, dis-embeds and alienates biodiversity from land. Offsetting makes nature portable, and as such, in a similar way to Warwickshire, BDO acts as a spatial rationalisation strategy 'making space for development'.

Although BDO is apparently attractive for being able to 'transcend tradeoffs' (drawing on an expression we encountered in chapter 4), it nevertheless still makes a claim on the financial resources of developers. With an explicit financial value, BDO is subsequently now positioned along side the other 'public good' planning contributions stipulated through the s106 agreement. On these grounds, the landowner Hallbaron Ltd. contested the requisite provision of the 25 per cent quota (already reduced from 50 per cent) for affordable housing in light of an additional biodiversity offset compensation 'burden' that had emerged. BDO compensation and affordable housing quotas now find themselves in conflict with one another, thereby threatening the profitability for the land sale and development. LPA1-SD informed me that:

> They couldn't come to a decision on affordable housing without full details of biodiversity and transport costs, because those are the costs that would impact what you can do with affordable housing because of the viability of the project. So, me and their consultant had to try and come up with a way of satisfying their biodiversity stuff, so we calculated their level of biodiversity loss and we were proposing to put it in the s106 that they needed to deliver x units of biodiversity and that could go up or down depending on the site layout and the design which would be determined at reserved matters. They needed and our

> planning officer needed some certainty around how much that would cost otherwise they couldn't come up with the affordable housing figures. (LPA1-SD 240714)

The timing at which BDO is introduced to the process is therefore crucial and but one of many practical challenges. The LPA officer overseeing the pilot told me that if BDO is introduced too late in the process it makes it easy for developers to contest on the grounds of financial viability targets, which it seems the local authorities are expected to show due concern for. The landowner's commercial expectations and those of the site promoter facilitating the land sale further heighten this conflict. All actors vie over maximising the value yields of a finite piece of land. LPA1-SD told me that:

> if you start off at the very end of the pipeline and go up to the beginning of the process you realise that so many of these problems are stitched up in the agreement between the site promoter, the landowner and the developer. The landowner has very high expectations for what they can get for their land…absolutely outrageous fortunes for doing absolutely nothing! They've got some land and one day its worth £25,000 per hectare and the next day its worth £500,000 and the change in value has nothing to do with anything that landowner has done to the land but probably reduced the biodiversity value of it in anticipation….The site promoter will be pushing as hard as possible for top value for that land on behalf of the landowner and his own pocket and suddenly you've got minimum affordable housing, minimum biodiversity and minimum everything because the landowner says my viability can't afford it!
>
> And what we're doing is tinkering at the end of the process with the scraps. We're seen to be adding financial burden to developers because they haven't considered it from the outset, and meanwhile the landowner is in the Bahamas! (LPA1-SD 240714)

The bottom line here is that land values in England have been spiralling for many years and this is arguably what shapes the economics of biodiversity considerations and the ability of LPA's to obtain financial sums of compensation. Land in England has long been treated as an investment asset especially since it dovetails with a hugely speculative housing market and increasingly financial interests in agriculture. Due to the enormous economic value disparity between agricultural or other non-development and development land, land's value is largely dormant until the moment it can liquidated

through a sale, as the post-permission land value figures from DCLG (2015) provided above attest. I return to this in the discussion points of this chapter.

Furthermore, my interviewee at Natural England and three separate LPA officers mentioned that it is not unusual for landowners to deliberately destroy biodiversity habitats on site before they apply for planning so as to reduce potential ecological hold ups or attract compensation costs. The point here is that landowners now have an explicit economic incentive to 'trash' biodiversity before they submit a site for planning permission. In economic theory this would be a called a 'perverse incentive' and indicates that making an 'asset' out of nature to incentivise landowners to nurture it can produce directly the opposite effect. This point bears relevance to some of the original rationales underpinning the idea of mitigation markets explored in chapter 4 through the Safe Harbour Principle.

Neutralising opposition

The development was, and at the time of writing still is fiercely contested by existing local residents on a variety of different grounds, but most strongly in relation to the beauty of the landscape and the mature specimens, diverse species and rich habitats it contains. During the planning committee meeting in July 2014, the local chairman for the Campaign to Protect Rural England (CPRE) provided a testimony against the development on the basis of the adverse impacts it would level on the landscape character:

> Building 255 houses on this elevated site will have an overbearing dominating effect on the landscape and detrimental effect on the Teign Estuary landscape and area. At the moment the views across the Estuary are typical of the rural setting. There is green crest that enhances the character of the town. The attractiveness and tranquility of the Coombe Valley will be affected by this large development. These unwelcome intrusions will detract from tourism, which is a vital industry in this area. (Peter Finch, CPRE 240714)

The CPRE was not a lone voice. The district council's online planning document archive showed that a total of 67 letters of objection and four letters of complaint were registered during official consultation period. The July planning appeal committee meeting was a heated affair, as local residents and the authors of these objections filled the spectator galleries at the district council offices. During much jeering, booing and clapping the Councillor chairing the meeting threatened to 'clear the gallery' should the spectators not quieten down for proceedings to peacefully play out.

Towards the end of the meeting, in a somewhat irritable manner the Head of Planning at the district council eventually shut down the debate and sharply rebuked an objector contesting the environmental impacts of the development. By drawing on the expression of 'net gain' the planning official was able to assert definitively that there simply was *no* ecological impact. The promise of 'no net loss' had been taken literally to nullify the actual loss. Objections to biodiversity loss were irrelevant given the agreement to perform biodiversity offsetting through the conditional requirements for compensation that would be set out under the s106. Wholly disregarding any technical uncertainty, the Head of Planning illustrated the potency of NNL as conceptual mechanism. Although the committee meeting was allowed to run to the end where ecological evidence was disputed between parties throughout, the technology of 'net gain' was eventually mobilised as a discursive strategy by pressurised in situ decision makers faced with intractable complexity of reaching expedient planning verdicts.

The introduction of a BDO system that promises to provide a measurable way to deliver compensation for residual losses served to neutralise opposition to the biodiversity impacts of the site. Theoretical expectations of BDO, anticipate that as a mechanism, it will have a tendency to weaken environmental protections through offering a 'license to trash' through skipping over the mitigation hierarchy towards compensation if and when contexts call for it (Clough 2014). Here the premise of the planner's enthusiasm for BDO to smooth decision-making processes was an unquestioned faith in the ecological restoration science as well as a tendency to ignore the spatial, biological and social specificities of existing habitats under question. This phenomenon is reflected elsewhere as the local branch of the RSPB described to me. In negotiation over the identification of sites for the future delivery of properties during the working up of the Local Plan, my interviewees at the RSPB told me the Planning Inspector was generally 'relaxed' towards the impacts of historic cirl buntings territories because he perceived that there was mechanism in place to compensate for the loss of the habitat. They reported 'he effectively said this is not an issue I need to deal with or be concerned with because you've got an agreed approach in place.' (NGO1- SD 0411214).

Biodiversity offsetting's technicians and theoretical architects such as eftec, IUCN and BBOP (described in chapter 4) maintain that the main barriers to success in BDO will be judicious observation and implementation of the design principles and associated thresholds. And yet there is a disjuncture between the intended audiences of technical guidance reports and those that eventually take planning decisions over development applications. For the most part, an ecologist's input into planning decisions is no more

than advisory. The final decision rests with officials from the planning department who are adjudicating between numerous areas of social and environmental planning policy. Even if the planning official was an expert in BDO theory and practices, the temptation to bend rules for expedience if an increasingly costly and pressurised planning resolution was proving elusive, is consistent with the wider political economy of planning discussed throughout this thesis. Taken to be a literal negation of biodiversity impact, on the face of it, ecological compensation solves the problem of restricted and otherwise difficult locations for the forward supply of more houses.

In reality, planning inspectors and other decision makers will be not be specialists in BDO technicalities. They are unlikely even to have a superficial grasp of BDO theory and its safeguards detailed in the technical literature. The temptation, as this example shows, will no doubt be to embrace offsetting and no net loss as a 'heuristically powerful' (Sullivan 2017b) mechanism to fit around and facilitate dominant political agendas (as 'valuing habitat' was for one of the clients of the sub-brokers outlined in the previous chapter). Theoretical principles, protocols and thresholds that may be methodically worked out in design and theory in practice can instead be found to be characterised by attrition, slippage and flexibility through the local interpretation to fit existing agendas. This appears to be a pertinent theme in the adoption of BDO at a local level where it is re-worked according to wider network of factors that shape it as a local hybrid. There is a re-scaling issue from its conceptualisation in theory to interaction with other values (Ong and Collier 2008)

Negotiating values with the Biodiversity Impact Assessment

Corresponding to the negotiations of BIA values described in chapter 5, the actors involved in this contract made adjustments to the input scores as a way to fit with the wider economic and political context of the planning application. Mirroring the experience at Warwickshire, these amendments derived from ecological incertitude in relation to the baseline habitats.

The ecological basis for the development itself was already heavily disputed. Natural England told me there were lots of holes in the application and lots of aspects that were inadequate from a biodiversity perspective. In particular, Natural England felt that the impacts on priority species habitats had been overlooked, which the officer said was disappointing:

> Some of the species there were quite rare and it was a nice mixture of different habitats as well, lowland meadow and woodland and wet grassland species rich

> meadow, you know it's all the component parts that forms a rich habitat structure and interest. (NE1-SD 241114)

Although the BIA scored values fluctuated over the course of these negotiations, the LPA officer acted to eventually increase the level of compensation the developer would be liable for. Time was pressurised, there was just a four month window between the submission of the consultant ecologist's latest ecological assessment in February 2014 (containing the BIA) and the planning appeal committee meeting in July. All parties needed to reach a conclusion over the biodiversity calculations so that they could agree on the final quotas for affordable housing. Yet the processes of translating ecological data from a phase 1 habitat survey to EIA report and finally into the DEFRA metric calculations was complex and messy. Through successive re-interpretations with the assistance of aerial maps, site design drawings and other textual inscriptions, the parties finally arrived at a set of stabilised values and associated agreement over the net biodiversity losses of the development. At least these looked like sensible calculations that parties could agree over in time for the final committee meeting in July.

In contrast to the process at Warwickshire where a sizable team of LPA ecologists and the resident Environment Bank officer translated the contents of the EIA into the BIA - in Devon, the consultant ecologist (CE1-SD) undertook this work in the first instance. As a desk based exercise, the developer's ecologist re-interpreted the qualitative narrative of the Ecology Report into the metric's codes. Spatial boundaries of habitat type, distinctiveness and condition were assigned and incorporated into the Excel spread sheet version of the DEFRA metric. Significantly simpler than the equivalent BIA being used at the Warwickshire pilot site, the consultant supplied this evidence as a cut and paste image of the spread-sheet in an appendix occupying the final two and a half pages of a 125 page report covering the qualitative ecological evidence in February 2014 (shown in Figure 16). Although Devon's actors did not refer to the metric as the 'BIA', it seems practical to refer to it as such within this account so that it is easier to reflect on the Warwickshire and Devon cases comparatively. As I have already mentioned, like Warwickshire, the valuation of biodiversity was a negotiated process. The calculations travelled through three overall versions between the consultant ecologist and the LPA before a final version was agreed for the purposes of the committee meeting. The iterative stages are described below.

Figure 16 Development site baseline and mitigation calculations included in the S106

Table A13.1: Habitat loss calculator

Ref	Broad Habitat	Habitat Type	Priority Habitat	Distinctiveness	Area	Condition	Required Units
			Y/N	High 6 Medium 4 Low 2	Hectares	Good 3 Moderate 2 Poor 1	Biodiversity units = C x D x E
SIN3	*Grassland*	*Lowland_Meadows*	*Yes*	*6*	*1.2521*	*3*	*22.54*
SIN4	*Grassland*	*Lowland_Meadows*	*Yes*	*6*	*0.2773*	*1*	*1.66*
PSI	Grassland	Improved_Grassland	*No*	2	5.012	1	10.02
I	Grassland	Improved_Grassland	*No*	2	1.3907	1	2.78
Marshy	Grassland	Lowland_Meadows	*Yes*	6	0.1116	1	0.67
scrub	Woodland	Scrub	*No*	4	0.054	1	0.22
other	Other_Features	Built-up_areas_and_Gardens	*#N/A*	#N/A	1.7698	1	#N/A

Table A13.2: Habitat creation calculator

Target												
Ref	Broad Habitat	Habitat Type	Priority Habitat	Distinctiveness	Area	Condition	Target Units	Gross Units	Risk Factors			Tradable Units
									Difficulty	Time	Spatial	
			Y/N	High 6 Medium 4 Low 2	Hectares	Good 3 Moderate 2 Poor 1			Low - 1 Medium - 1.5 High - 3 Very High - 10	5yr - 1.2 10yr - 1.4 15yr - 1.7 20yr - 2 25yr - 2.4 30yr - 2.8 32yr - 3	Contribution to conservation (ask LPA): Strategic / Onsite - 1 Semi-strategic - 2 Non-strategic - 3	
Species-rich grassland	*Grassland*	*Lowland_Meadows*	*Yes*	*6*	*0.6563*	*3*	*11.8134*	*10.501*	*1*	*1.2*	*1*	*8.75*
Wildflower lawn	*Grassland*	*Lowland_Meadows*	*Yes*	*6*	*2.043*	*3*	*36.774*	*32.688*	*1*	*1.2*	*1*	*27.24*
scrub	*Woodland*	*Scrub*	*No*	*4*	*0.2791*	*3*	*3.3492*	*2.791*	*1*	*1.2*	*1*	*2.33*
Orchard	Woodland	Traditional_Orchard	Yes	6	0.1735	3	3.123	1.041	1	1.2	1	*0.87*

Table A13.4 Summary of habitat loss

Broad Habitat	Habitat type	Priority Habitat	Required Units	Tradable Units	Net Gain
		Y/N	Units	Units	Units = E - D
*Grassland_*	*Lowland_Meadows*	*Yes*	*24.87*		*-24.8712*
Grassland	*Improved_Grassland*	*No*	*12.81*		*-12.8054*
Grassland	*Lowland_Meadows*	*Yes*		*35.99*	*35.9907*
Woodland	Scrub	*No*	0.22		*-0.216*
				Overall Gain	**-1.90193**

Source: Consultant Ecology Ecological Impact Assessment 2013

Version 1 – consultant ecologist's calculations, February 2014

The first calculations performed by Hallbaron's consultant ecologist presented the biodiversity baseline as comprising 37.90 units. As mitigation works, the consultant ecologist proposed the onsite creation of 35.99 units (the difference in between these two numbers is the residual net loss at 1.9). Three hectares of lowland meadow creation would act as this mitigation. Lowland meadow has the highest distinctiveness score, and in the good condition that they proposed they would create, offered the highest value habitat creation possible. The scale of this proposed grassland creation meant that in terms of biodiversity units, it would replace almost all the units that were to be lost through the development. On looking closely at the plans, the developer and their consultant ecologist had allocated practically every square metre that wasn't a road, house or garden as a lowland meadow to act as biodiversity mitigation. LPA1-SD found this to be an overly ambitious assessment of onsite mitigation and produced a second version.

Version 2 - changes to baseline valuation and mitigation proposal, April 2014

Two months after receiving the initial consultant ecologist's application, the LPA made several corrections and recommendations in response. These included a marginal increase to the site's overall biodiversity baseline and a significant reduction in the number of credits proposed as mitigation. LPA1-SD drew attention to the incorrect inclusion of multiple condition step changes between baseline and target mitigation works. To assume that all biodiversity on site would be lost (as the BIA does so) and then a highly distinctive habitat in good condition could be created in five years was literally (in the metric's terms) a couple of steps too far. The 'upgrading' of improved grassland with a low condition (score 1) to a lowland meadow in good condition (score 3) within a five-year period was contrary to DEFRA guidance. Five years is too short a time frame for such a dramatic habitat category improvement.

The officer made adjustments to the baseline through changing the sizes of proposed habitat impacts as well as adjusting the allocations of particular habitat categories. For example, the habitat parcel code SIN3 occupies the first row of the developer's calculator metric showing a score of 22.54 units in version 1. Under version 2 the officer reduced this baseline score to 15.41 mainly through reducing the overall size of habitat impacted (by almost half a hectare - 0.4 ha). Other changes included corrections to an erroneous habitat distinctiveness categorisations. This error had resulted in the 'under-valuation' of

the poor semi-improved grassland (Excel reference PSI). This correction served to produce an increase by 8.44 baseline units (from 10.02 in version 1 to 18.46 in version 2).

The officer reduced the proposed mitigation scores by reducing the distinctiveness score from (6 to 2) of the very large area of proposed lowland meadow. He also re-classified the mitigation as a wildflower lawn with a moderate condition score of 2 (from good, 3). This adjustment, due to its size reduced the mitigation scores for this category from 27.24 to 8.17 units. Overall, the LPA reduced the mitigation score from 35.99 to 11.27 units from the first version submitted in February to the second that was returned to the consultants in April. Meanwhile, the baseline was slightly increased from 37.90 units in February to 41.35 units in April. However, an error that the LPA officer made on the Excel spread sheet equation erroneously omitted three of the cells of the Total column (noted in summary Table 9 below). Thus the baseline was mistakenly communicated to be 38.41 units until it was later corrected in the third version of the BIA. The omission of these three cells resulted in a shrunken credit value to compensate the impact by 2.94 units, which according to the pricing methodology they were using, could have translated into roughly £30,000 of compensation. Overall, the score changes between the first and second versions made the ambitious mitigation measures look more realistic and comply more closely with DEFRA's technical guidance on habitat valuations.

Table 9 Summary of changes to metric calculations over time

(All units are 'biodiversity units' unless otherwise noted)

	V1 February 2014	V2 April 2014	V3 July 2014
	Consultant ecologist	LPA response	Final at outline permission
Impact (baseline)	37.90	38.41 (41.35)*	47.41
Creation (mitigation)	35.99	11.27	23.93
Net loss	1.90	27.14	23.93
Hedgerows Net Gain	-638.333 (m)	-638.33 (m)	-638.33 (m)
Number of hectares supporting habitat mitigation	3.15	2.97	3.94

*This is the actual value but the excel formula had erroneously omitted to sum cells N14-16 thereby artificially reducing the total value on site.

Version 3- changes to the baseline, July 2014

The final BIA version was agreed in July 2014, immediately before the planning committee meeting. In this draft, the baseline value was stabilised to be 47.41 units. Although the LPA had lowered the mitigation scores between February and April, between April and July 2014 (versions 2 and the final version 3) a decision was taken to include two additional parcels of land adjacent to the development site - a small rectangular field at the top of the development and a larger triangle to the west (observable in the different aerial depictions between Figures 13 and 14 and 15). These additional parcels represented an extension of the overall mitigation work and had not been allocated within the original zoned design of the Local Plan. The extra sections of land were included so as to meet Natural England's requirements for SANGS as compensation for potential recreational pressures on the nearby SACs. However, these supplementary hectares also ended up doubling up as BDO mitigation and therefore reducing the net loss of the development accordingly. LPA1-SD informed me that

increasingly SANGS is being merged with biodiversity offsetting requirements. Natural England would now accept SANGs as a form of biodiversity gain classed as onsite mitigation. The two compensation requirements in combination were considered by Natural England to prove too punitive for developers (LPA1-SD 270215). Natural England's consideration for the developer's bottom line simply echoes a comment that a Natural England officer made to me and reflects the wider political emphasis on economic growth discussed in chapter 4. My interviewee at Natural England said, 'at the moment there is a big emphasis on growth and as an organisation we have a responsibility to look for solutions ensuring that the environment is not in conflict with that' (NE1-SD 241114).The addition of these parcels of land, totalling almost a hectare, provided the much-needed extra onsite habitat creation of lowland meadow habitat to improve (mitigate!) the now relatively low mitigation score. The BDO mitigation scores under the third version jumped from 11.27 to 23.93 units.

Within the process I have described, every single one of the equation's attributes (habitat area, distinctiveness, condition) fluctuated. Indeed, the format of the calculator *itself* evolved for improved clarity and detailed representations. As the researcher trying to make comparisons across different layers, this made my job tantamount to forensic (biodiversity) accounting. I was trying to see how value translations had occurred and where they had been adjusted. None of the biodiversity (baseline nor mitigation) scores was a stable representation. As BIA versions progressed, uncertainties increased with each successive layer of abstraction, resulting in massive flux to value scores. Yet the scores latterly appeared as scientific technicalities within the planning committee meeting in July, whereupon the council's planning official could proclaim that there simply 'was no ecological impact'. This development had produced a 'net gain' for biodiversity and the prior negotiations disappeared from view.

In South Devon, BDO underwent various hybridisations. I have described the first whereby the mitigation procedures of the offsetting had been subsumed to other ecological compensation mechanisms such as SANGS. The second relates to ways in which BDO's wholly habitat focus was modified to account for the prevalence of protected species requirements in the area. This hybridisation was related to efforts to account for the RSPB's existing regional conservation priorities. The overwhelming focus of these priorities were on cirl buntings as a small farm bird restricted almost wholly to this area of South Devon. This is the focus of the following section.

6.4 Assemblage convergences; making a biodiversity offset hybrid

The absent supply side

Like Warwickshire, the pilot study encountered a general paucity of receptor sites. A receptor site had not been secured during the period of fieldwork although two sites were being considered. One option would be land supplied by the RSPB and the other one from land owned by the county council. The county council site was the favoured candidate but to be furnished with RSPB advisory services (LPA1-SD 270215). The county site was located just 3km to the north west of the development and was a grassland and low input arable field. With some specific interventions, it offered potential for the summer and winter foraging habits for the population of cirl buntings. Although the site was council owned, it was a tenanted farm. The farmer was old and likely to soon retire and the opportunity for a new lease was therefore probable. Under these circumstances, LPA1-SD thought that any new tenancy could be modified to require certain land management approaches specifically to benefit cirl buntings. In the end, the county council receptor site was not available, since the council itself was reluctant to commit it to a BDO 'in perpetuity'. The LPA1-SD, informed me that it was probable that in the end the overall compensation would be split across three receptor sites due to not being able to find one that was big enough.

The LPA1-SD had considered whether the district council should themselves be investing in land to provide biodiversity offset credits. The idea was apparently unfeasible. Council owned land would be accounted for under the local authority asset register, and in times of hardship would need to be sold (LPA1-SD 240714). At the same time, both the district council and the RSPB say that it would be preferable to own the land so that they would have better control over the offset delivery process. This is a feature of the arrangements that reappears strongly in the following case study and that other NGOs encountered with attempting offsetting. A ready supply of land was envisaged to also help direct and deploy collected compensation funds quickly with benefits for the time lags between impact and gains, in many ways reflecting the habitat banking model introduced above in chapter 5. As I have already established, however, land is an expensive capital cost for the purposes of conservation. Even if this land becomes economically productive and a source of rent for biodiversity offset markets, there is a still a substantial upfront outlay and considerable uncertainty over future revenue streams for biodiversity units.

Regardless of who actually owned the land, it was envisaged that the RSPB would play a central role. Indeed, it had been their pricing methodology developed through their unofficial form of cirl bunting compensation that had stood in in the absence of any other alternative. The idea was to translate the (generic DEFRA scored) habitat loss into a cirl bunting species-specific gain.

Translations from one unit to another

For the decade prior to 2012, the RSPB had been developing their own unofficial version of biodiversity compensation but specifically in relation to cirl buntings. The RSPB wanted to 'get something back' for cirl buntings since the incremental losses were leading to population scale impacts on the species of bird that was in the recent past, close to extinction. As such, the RSPB's priorities for cirl bunting conservation had been retained such that they were now morphing with the BDO approach within the pilot.

In the spirit of pragmatism under time constraints and in the absence of any other available method for pricing the financial value of the units, the LPA used the RSPB compensation pricing method (LPA-SD 270215). The drafting of a financial sum in time for the committee meeting in July 2014 so that it could be included within the s106 conditions was urgent. Additionally, the development site described in this case study was thought to be being used by cirl buntings and a single pair was picked up during a reptile survey in the consultant ecologists' EIA (but invisible to the generic abstractions of the BIA). The RSPB were therefore eager to ensure that compensation would directly benefit the species (if not the individuals to be affected).

As such, in conjunction with the RSPB, the LPA agreed that the 'residual loss' of 23.93 biodiversity units to be delivered as an offset would be compensated with *cirl bunting specific* agricultural grassland. The trouble was - how to make 'biodiversity units' into 'cirl bunting units' for the practical purposes of costing the compensation? How does a biodiversity unit become equivalent to one hectare of cirl bunting habitat? The value fields were incommensurable and the methodologies of calculation were entirely different. Much like the single attribute of acreage currencies used in wetland mitigation banking in the US, cirl bunting compensation relies wholly on spatial area (ha) as the primary unit. This measurement stands in contrast to the DEFRA metric's compounding of generic habitat indicators of distinctiveness and condition that are then multiplied by spatial area.

The translation process highlighted in the s106 text stipulates that one biodiversity unit is proposed to translate to 0.14 cirl bunting hectares. Conversely, one cirl bunting hectare is worth 6.9 (grassland) DEFRA biodiversity units. The development was thought to produce a residual loss of 23.93 units of grassland, as the third version of the negotiated scores. The compensation requirements in the cirl bunting hectares therefore translated into 3.46ha. The workings are shown in the equation below.

0.14 cirl bunting hectares = 1 biodiversity unit

or

1.0 cirl bunting hectare = 6.9 biodiversity units

$\therefore$

23.93 biodiversity units / 6.9 biodiversity units = 3.46 cirl bunting hectares

In some respects, it was simply pragmatic for the LPA to incorporate elements of a calculative and habitat costing approach that had been under development since 2005. But the RSPB had their own reasons for amalgamating their approach with DEFRA's. Conservation officers at the NGO were extremely concerned about the risks to their established conservation priorities for cirl buntings. The DEFRA metric, being habitat focussed, simply did not 'see' or value cirl buntings as a species. What's more, since it functioned by subsuming habitat mosaics and diversity into a single number and permitted the replacement of alternative types of habitat for the equivalent numerical value (see commensuration discussed in the previous chapter), any specific focus on directed conservation priorities of species would be lost. The RSPB anticipated that should BDO be adopted as a new conservation standard, the cirl bunting habitat specificities would disappear within a habitat offset that was completely unrelated to the birds' needs but instead emphasised perceived equivalent numeric values.

Cirl bunting habitat is comprised of particular patterns of shrub and stubble crop formation, adequate open space and distance from residential areas (LPA1-SD 201113). None of these peculiarities would appear as input or output values on the BDO metric nor would be captured by generic habitat types. As such, the RSPB enthusiastically engaged with the local DEFRA pilot study so that they would be 'at the table' and to ensure that the introduction of BDO did not weaken their existing work with cirl buntings. The RSPB were at pains to emphasise that their enrolment to the BDO approach was simply a 'pragmatic' response to a political situation largely unfavourable to protected species conservation designations. They discussed how Ramsar sites and

SSSI's are frequently built over anyway with little recourse to meaningful compensation or political will to observe protection policies. In general terms, my interlocutors at RSPB were not in favour of compensation at all since it simply indicated that the planning system was failing to meet biodiversity commitments through meaningful land planning and protection. The individuals I spoke with at the RSPB felt nevertheless, that this was the *only option* to get 'something good for cirl buntings'. With this in mind they were very clear that they were not administering the compensation money, nor would the developer be 'passing a brown envelope' to the RSPB.

Even so my respondents also questioned the effectiveness of their existing offsetting system as they had received so little actual funding to date. They said

> If the approach works and it is effective then there should be no net impact, but it is a big if... so we taking a bit of a leap of faith, but as I said our reality is that in the absence of this sort of approach the development would proceed anyway, and cirl buntings would lose out. (RSPB-SD 241114)

'Problems of measurement' and pricing the offset

Valuation begins with measurement and classification - what Bowker and Star (2000) call, 'sorting things out' so as to isolate within dynamic ecological assemblages 'who is doing what to whom' (Yusoff 2011). In this respect, Robertson (2000) discusses the difficulties regulators faced in settling over what exactly constituted a 'wetland' as a stabilised category against which a standard spatial area of wetland could be made coherent. In this example with cirl buntings, ecologists and planning officers faced similar problems in seeking agreement over what exactly could be defined as one hectare of cirl bunting habitat.

Like an Excel spread sheet, neat boundaries are fundamental to the calculative drive of BDO. So as to be calculated, something must first be calculable. Callon and Muniesa (2005: 14) propose that this process entails the singularisation of goods through their 'extraction, translation and (re)formatting'. As Callon argues, goods involved in calculations must be *disentangled* and *framed* (2006: 186 emphasis added). Castree (2008) labels this process individuation and is central to commodification. The production of framed or individuated units subject to being quantified, monitored and rendered equivalent to other one-hectare units elsewhere is therefore essential to the making of a market good out of habitat. The LPA's draft cirl bunting approach informed by the RSPB seeks to eventually aggregate enough single hectare compensation

payments to create an entire habitat for a cirl bunting pair. But first the substantive units must be established. The economic framing requires suppressing inconvenient scientific uncertainties. In an interview, the local planning officer notes:

> There are question marks as to what the trigger is for that one hectare. A breeding territory is a 250m radius from a singing male, who will generally be singing fairly near or within a 250m radius of his nest. The problem is that when you record him, he may be on the 250m mark away from his nest. We then put a theoretical 250m buffer zone around this singing male and say *that* is his breeding territory. A 250m radius creates, I think it's about a 19 or 21-hectare area, so if you lose five per cent of that area that equates to about 1 hectare. (LPA1-SD 201113)

The pricing methodology for the offset was therefore based on hectares gained rather than the delivery of biodiversity units. The s106 agreement outlines the financial costs associated with the per hectare compensation for cirl buntings:

> The biodiversity offsetting contribution' means the financial contribution of £61,475 per hectare of habitat (or pro rata where less than a full ha is required) to provide compensatory alternative off site habitat in accordance with paragraph 6 of the Third Schedule. (S106 October 2014: 4)

The cirl bunting offsetting process developed by the RSPB valued compensatory habitat to be £61,475 per hectare for breeding pair of cirl buntings. The local authority draft cirl bunting guidance furnished by the RSPB advice sought to aggregate the spatial units (single hectares) of loss over time in order to pool the funds to create a larger cirl bunting nature reserve elsewhere to be delivered in partnership with the RSPB (LPA1.1 Nov 2013). The RSPB cirl bunting calculations did not include risk multipliers but if they had been, they would have likely resulted in a much higher figure than £61,475 by reflecting the temporal disjuncture between habitat loss and creation.

Various cost lines make up the total figure of £61,475/ cirl bunting hectare. The sum, however, reflects the average between two plausible scenarios, one, which necessitates land purchase, and the other that doesn't. The annual habitat management costs for either scenario hover around £2,500 a year. This includes nine days of council time for monitoring and evaluation along with various landscape management works such as hedge laying every eight years and other general management, grass topping and cereal

planting. In seeking to adhere to a principle of 'in perpetuity' such that the compensation money achieved for this single hectare is not stripped over time to manage the annual costs, the LPA devised a financialised means of procuring an annual flow of income as interest on a capital sum as an endowment. The capital sum deemed necessary, based on the assumption of a five per cent return (amounting to £2560 per annum) was extrapolated to £52,600. In a scenario that required the soliciting of land in the first place, there would also be the price of the land, legal fees and, the initial up-front costs. Buying land would cost an additional roughly £15,000 made up from the market value of agricultural land (£8000), solicitor's fees and council staff time.

The two cost scenarios for a single hectare of cirl bunting habitat are either £52,600 (without land purchase) or £70,349 (with land purchase). The figure of £61,475 is the average of the two sums since the absence of identified offset sites means it is often not known whether land will need to be purchased for the purpose. The RSPB put together this calculation for compensation per cirl bunting hectare in 2005. The sum calculations were based on what they felt it would cost them to buy land for cirl bunting habitat, make capital improvements and manage it going forward. More recently, during the BDO pilot period, the overall figure was increased to £72,000 as the original value of £61,475 was not inflation adjusted.

Emerging tensions between different conservation compensation frameworks

The divergences in these alternative regulatory frameworks (BDO, SANGS and EU Habitats Regulations) and associated environmental 'goods' to which they correspond triggered a core tension in the valuation process. Since BDO mitigation activities were encapsulated under SANGs, the land provided needed to be directly adjacent to the development so that it constituted practical alternative green space that the new residents could use. And yet, in our interview, the RSPB emphasised that cirl bunting compensation needs to be located *offsite* and entirely separate from the development. The RSPB proposed there is no evidence of effective on-site mitigation for cirl buntings apart from in very rare cases with 'an awful lot' of RSPB support (RSPB1-SD 241114). Prior experience has shown that cirl buntings' habitat needs can not be reconciled with the needs of the human population given that they have come to depend on corn stubble fields in arable landscapes. Furthermore, they often suffer with dog and cat predation from local residential populations (RSPB1-SD 241114). This issue was emphasised by a principal planning officer at the district council, who suggested that for BDO to work for cirl bunting, the offsets would need to be far enough away from all development, to save

them from encroaching urbanisation over the years. The tensions between onsite mitigation and urban development are likely to be felt in other ways too that will likely bare relevance for policy efforts to enforce the mitigation hierarchy. Frequently the biological needs of non-human populations are incommensurate with the aesthetic preferences of human populations:

> The RSBP agree that small patches of on-site stuff don't necessarily guarantee the viability of that species because of the highly specific way that habitats have to be managed to benefit them. So, you need rough tussocky grasslands that are invertebrate rich with shaggy fat tall hedges, and that doesn't really look nice in a new development! (LPA1-SD 201113)

6.5 Discussion

Following the conclusion of the pilot study, South Devon has retained BDO as an approach saying that the 'processes and tools remain a valuable mechanism for securing biodiversity compensation under planning policy' (South Devon Guidance on BDO October 2014). Valuable as the mechanism may be, or indeed may become (given the overall paucity of actual offset arrangements during the pilot) more than anything, this case study has illustrated how difficult it can be to ground BDO in some contexts, especially where it collides with existing arrangements.

In comparison with Warwickshire, Devon struggled to establish BDO more widely in the district and county council planning processes and therefore enact BDO in practice. The chapter opened by considering the context of the pilot site. It followed the unique arrangement of actors there and much like the previous case study, identified the work that one individual, through a belief in the prospect of BDO to deliver better biodiversity outcomes, largely pushed things forward. Perhaps an important difference between the sites was the institutional context and relative authority of the actors leading the pilots. The South Devon pilot was being driven at the district council level and not by the Head of Ecology at the county council, with implications for the associated respective influence that these two positions might wield.

In conclusion, this chapter highlights five significant findings for the development of BDO and making of biodiversity values within local government processes detailed below.

1. *Re-scaling and muddling through: the incongruities between the idealism and realism of BDO*

Ong and Collier (2008) propose that 'global forms' are rather articulations of specific situations and territorialised assemblages since they are comprised of collective material and discursive relationships here. As a socio-technical practice that depends on the coming together of many different things at once, this case study illustrates how BDO collides with other assemblages in specific circumstances and sparks situated enactments. The hybrid arrangements belie efforts to standardise biodiversity values under offsetting and therefore compromise the development of biodiversity accounting frameworks. As Li (2014: 589) has noted in respect to the assembling of land as resource, 'it can wax and wane or morph as technologies are added, values change and material qualities shift'. This chapter has highlighted some of the in situ aspects that shaped how BDO and the values of biodiversity were made in practice at a local site with anomalous features. The fissures that this re-scaling opens up, point toward the incongruence between the ideal of BDO and local realities in which it must ground itself. This disjuncture subsequently leads to various forms of hybrids, or as Deleuze and Guattari (1987: 157) articulate, 'monstrous crossbreeds' on which I expand in the discussion below.

This incongruence pertains also to the disjuncture between the theoretical and idealised frames of the 'green' economy, and actors' motivations for embracing BDO as a market based instrument in the first place. In Devon, actors in the LPA and wildlife NGOs were enrolled into the assemblage, but their reasons for becoming so were grounded in a pragmatic sense of muddling through, of 'making the best of a bad situation'. For the RSPB, this meant joining in with BDO simply not to be 'left out' and so actors within the NGO could monitor the implications of the new approach for their existing conservation priorities and strategies. In so far as the logic of BDO is reproduced, sometimes unwittingly, actors here adopted and reproduced BDO's substantive logics as 'economists 'in the wild' (Callon and Rabeharisoa 2003). While they adopted a valuation rhetoric uncritically, actors were governed by the organisational values of their specific context as well as normative objectives or professional ambitions (this is something I further develop in the following chapter in the Thameslink Programme). They sometimes subverted BDO's arrangements to advance their own existing agendas, as we saw the RSPB had successfully managed to do with their cirl bunting strategy. These findings are significant because they show how BDO assembles through its ability to enrol of new people into its arrangements, whether or not they believe in it as a model.

2. *Making a hybrid currency and building bridges between units: choosing between habitats, species and 'biodiversity' units*

As well as the unique attributes of its arrangements, this case study has illustrated how BDO in South Devon collided with existing conservation assemblages in relation to priorities for specific species and other EU habitat regulations statutory policies under SANGS. Biodiversity values are thus shaped by arrangements at local sites. Anna Tsing (2015: 162) has recently argued that 'the units one uses depends on the story one wants to tell'. In chapter 2, I outlined some of the unit abstractions that function as ordering practices structuring the knowledge and practices of biodiversity conservation. These units include categories of habitats, species, or biological records of individuals as numbers in databases. Even the term 'biodiversity' is its own meta unit or category (Maier 2012). So as to observe the effects of these framings, Fredriksen (2017) helpfully labels the units comprising modern conservation science and practice as biodiversity's 'non-market' values, but semiotic values all the same (c.f. Graeber 2001). In chapter 2, I discussed scholarship that has identified how these non-market values predispose their translation into market values reflected in price (Turnhout et al. 2014, Fredriksen 2017). Indeed, the first steps of the practical process of making a commodity are its abstraction to units, which can subsequently undergo monetary pricing (Robertson 2007, Castree 2008, Kosoy and Corbera 2010, Pawliczek and Sullivan 2011).

In this chapter, we encountered complexities in constructing BDO's unit abstractions in ways that bring Tsing's (2015) observation to life. Habitat units collided with species units in the making of 'biodiversity units'. So as to accommodate the conservation priorities of cirl buntings as a 'flagship' species, the LPA officers overseeing the pilot enacted a unit translation from habitats to species. In order for the habitat-species currency hybrid to function, the users of the metric interpreted and translated biodiversity units (based on the equation for habitat hectares made up of generic habitat attributes x spatial area) into cirl bunting habitat hectares (specific to species). As described in chapter 4, habitat hectares under the DEFRA model produces biodiversity 'units' through a compound of generic habitat attributes and acts as a 'coarse filter' (Kiesecker et al. 2009, Treweek et al. 2009).

DEFRA recognises that the metric cannot account for species, nor was it ever supposed to. And yet the question over what LPA's and developers should do on encountering protected species was an issue that remained unresolved following the pilot period. This issue was noted by pilot stakeholders at various stages along the way, for example at a mid pilot term meeting between the participants and DEFRA, and also in the final

evaluation report that was submitted to DEFRA in 2014 and eventually released in April 2016 (Baker et al. 2014a).

Given the level of technical and abstract fudging and overall 'muddling through' we have seen the application of the BDO metric entails, one can only imagine the difficulties associated with developing a metric that simultaneously values the generic attributes of habitat *as well as* the specific ones for particular 'flagship' species. Indeed, economic sociologists have discussed the fallibilities of accounting systems that, through their drive to internalise everything, unavoidably create new outsides, in practices of 'perpetually incomplete' accounting (Lohmann 2009). Should these two units be combined under one valuation technology or should they be separated? If they are separate, how should users decide which one to use and when? In chapter 4, I illustrated that the metric was designed to forge a compromise between pragmatism and precision. The combination of two different scales of units would require an even more technical methodology, different or incompatible exchange rules and even more value inputs to the equations, ultimately only serving to make the calculations more complicated and unwieldy. It would also likely result in further scope for interference and adjustment to the valuation scores by actors seeking expedient outcomes. There is thus an apparent tension between these conservation frameworks that 'see' and therefore 'value' different bits of and (given the hierarchy of regulatory frames) prior 'worths' of biodiversity. The tension reflects one aspect of the arbitrary 'cuts' to nature (Apsotolopoulou and Adams 2017) that BDO performs so as to produce a value for biodiversity by actors, *in practice*.

It is perhaps apposite to reflect briefly on other value assemblages that have historically shaped conservation priorities. Some of these priorities value particular aspects of biodiversity, or various species over others. Jamie Lorimer (2006) for example, through exploring the history of the UKBAP framework, and the framing assemblages of which it is itself composed, illuminates the contingent history of these extant biodiversity hierarchies that have stabilised within English conservation policies and traditions. Lorimer notes that the various taxa of the UK's biodiversity are valued and generate unequal conservation attention due to what he refers to as the 'grooving' of institutional imbalances and scientific capacities in their favour (ibid.). Some species have historically been more detectable and thus visible to surveying and data collection, others have been historically privileged due to their charisma (ibid.). Might the pragmatism of the habitat's 'coarse filter' therefore 'groove' the direction of English conservation towards the values of the metric, at the expense of other species, taxa or habitat blends?

Lorimer's insights are significant to this case study given the role of the RSPB in the process. Conservation NGOs, Lorimer argues, tend to be single taxa focused, and as such, shape conservation priorities (and consequently the production of material landscapes). NGO's use their 'strength and power' to champion a particular species which is reflected in conservation policy (Lorimer 2006). It is this disproportionate attention that some species and taxa receive over others that prompts Lorimer to ask, 'what about the nematodes?' Indeed, this preoccupation with a particular species in conservation value, and the translation above from generic biodiversity units into cirl bunting units reflects the wider inconsistencies and fallacies of equating specific species as proxies for biodiversity more generally (Maier 2012). The tensions over the appropriate surrogate to use so as to standardise conservation values and associated actions are yet to be resolved. These tensions are also indicators of the somewhat precarious and arbitrary basis on which BDO is founded and is enacted and adapted by users in situ.

3. Conflicted interests, regulatory oversight and institutional arrangements

The prospects for embracing a technical metric in efforts to rationalise decisions over the disposal of biodiversity must crucially be reviewed and assessed in light of the institutional arrangements in which it is used (Walker et al. 2009, Muradian et al. 2013). The majority of users will first and foremost be consultant ecologists in service to developers as their benefactors and clients. Several of my interlocutors noted the well-known conflicts of interest that this facet of conservation through planning opens up. As consultants under contract to a developer, it is perhaps unsurprising that the net impact and mitigation scores are being 'calculated' to minimise residual losses and thus financial compensation requirements for their clients. The LPA officer in this case study spent considerable time working through and moderating the ambitious mitigation scores the developer had proposed. But this was a pilot experiment and not therefore a 'normal' condition for a planning application. As such, the planning case was given very detailed attention, and arguably far more than an average planning case would normally receive. It is hard to see how biodiversity officers and ecologists at LPAs, (who are already extremely time poor) will have capacity to oversee or scrutinise metric calculations for multiple developments as they come through the planning process. This case study illustrates that such inspection, nonetheless, will be necessary so as moderate unrealistic BIA scores.

DEFRA envisaged that Natural England would provide independent oversight of these BDO processes. Although in South Devon, Natural England admitted that, even after the

end of the pilot period, they 'didn't really understand the metric' (NE1-SD 241114). In any case, the Government's environmental advisory service is undergoing sustained budget cuts expected to reach an almost 30 per cent overall reduction by 2020 (Vaughn 2016). Furthermore, Natural England acknowledges that going forward they will make only 'proportionate use of their regulatory powers' and expect to have to forge partnerships with private clients (ibid.). In other words, Natural England's income will increasingly flow from client relationships with private firms, the same firms they are expected to challenge on environmental impact grounds. Furthermore, the chapter illustrated that BDO was also being combined with or perhaps more accurately, subsumed under SANGS, as mitigation for potential impacts from visitors to the nearby SACs. The objective for combining BDO with SANGS was to achieve expedient outcomes that spared developers from what was, curiously, considered by Natural England to be overly punitive compensation of two frameworks in concert. This point is consistent with the broader political economy around the introduction of BDO and the pro-development emphasis flowing from central government, discussed in chapter 4.

The NPPF's 'presumption in favour of sustainable development' holds as much sway for Natural England as other civil sector environmental professionals. It is difficult to emphasise strongly enough that this is the broader political reality in which BDO was mobilised and tested, and continues therefore, to operate in England. Biodiversity offsetting was justified by DEFRA on the grounds of making planning 'quicker' and more efficient. To pursue such a goal without acknowledging the existing disintegration of regulatory capacity and thus the authority to which metric users are accountable, seems only to point towards a system that is generally far weaker for preventing impacts on biodiversity, even if it is 'quicker'. Much like many other observations I have drawn upon in this and other case studies, this institutional direction of travel does not seem to be consistent with the proposed 'step change' for conservation articulated as urgent by John Lawton and colleagues in 2010.

4. Precarious calculations and black boxes

Far from being anomalous to Warwickshire (also see Sullivan 2013b), valuations in South Devon were also malleable and locally configurable rather than 'closed facts' (Blok 2011). While in Warwickshire, the BIA numbers were adjusted at the explicit behest of the developers, in South Devon, the fluctuation was driven by efforts to moderate the extravagant mitigation scores submitted by the consultant ecologist. The difficulties in achieving scientific certainties over spatial habitat boundaries of impact, habitat

conditions and the exact habitat categories onsite also influenced the negotiated processes.

Like Warwickshire, the contexts in which these decisions are worked through by stakeholders were crucial. The value outcomes of an algorithmic device will simply reflect its data inputs. As this and the previous case study has shown, many factors come to bear on how those inputs are gathered and decided over. Over the course of the negotiation, biodiversity loss and gain was represented through qualitative categories, numerical scores and spatial areas of habitat parcels. Each of these representations travelled through increasingly abstract and theoretical stages of negotiation. This showed that what tends to be accepted as realist representations, are instead thoroughly mutable so as to fit around the political and economic contexts of the negotiation processes (and its pragmatic limitations). These textual representations as numerical scores are stabilised over the metric process, such that it is not clear to the final user how they have changed or what their origins were. The numbers can be said to have been 'black boxed' (Callon and Latour 1981, MacKenzie 1990, 2008) in ways that conceal uncertainties, precariousness and politics from view.

The implications for these black boxes are thus made apparent in the ways in which other actors downstream to their calculations 'consent to the adequacy of their representation' (Robertson 2012: 396). This is where the political work of BDO as calculation practices start to become apparent. We saw that in two separate incidents within this case study, where planning officers and inspectors were eager to embrace the existence of these calculated scores as established fact so as to fit around their needs at the time. It is precisely the ways in which these stabilised numbers move through wider networks of decision-making within planning processes that they are endowed with agency. If calculations are used, planning officers and inspectors consider the outcomes to be rational and scientific standards. Instead, however, these numbers are predicated on various concealments.

Notably in addition to the scientific uncertainties, the missing values in all of this appear to be those of held by the actual people who reside in and around the landscape subject to residential developments. These local values of aesthetic and spiritual appeal have no way of being accounted for within such calculations. While not visible in the calculative processes, these actors were not, nonetheless, silent witnesses to the process. They staged an active and on-going campaign to resist and contest the development and the grounds on which it was being justified. Since concern over green spaces and nature

valued by local people is largely not recognised by planning policy or processes, residents resorted to articulating their complaints in scientific or neutral terms according to bureaucratic policy frames for 'biodiversity' values in general.

Contesting development on the grounds of aesthetic, cultural or social value of nature, or because of values that are local to the community or its individuals, at least at higher levels of planning, is easily dismissed as a form of parochial 'NIMBYism' (LPA1-SD 240714). Such justifications are not commensurate with bureaucratic planning values because they fall under different orders of worth (Boltanski and Thévenot 1999, discussed further in chapter 8). But it is precisely the translation of such concerns into generic, universal standards in drawing on the numbers of biodiversity's ascribed values which ostensibly demonstrate a 'no net loss', that makes them, conversely, so easy for the planning officers to discharge. In this circumstance, the attribution of a value to biodiversity made it even more disposable than before (Bracking et al. 2014) because it neutralised the grounds of contestation. The representations of mitigation scores, and the writing in of a compensation sum into the s106 associated with this development permitted the Head of Planning to assert that there simply was *no* biodiversity impact. In abstract terms, the books had balanced, even if the compensation was proposed to benefit cirl buntings and the absence of a readily available offset location would probably mean being the compensation would be split across three separate sites. The specifics of intact and in situ biotic assemblages and the broader landscape character of which these were a part were eclipsed in the ostensibly rational decision making processes.

5. Valued biodiversity and land values

Attributing an explicit financial value to biodiversity will inevitably affect the value of the land on which it dwells. This case study shows how BDO has implications for changes to land value and affects the way landowners will subsequently treat it. With a plain economic value, biodiversity can be viewed as either an asset or a liability, depending on one's intentions for the use of the land and entirely dependent on wider land market conditions. In respect to the first point, scored biodiversity amounting to compensation requirements of £100,000 translates to an equivalent reduction in value of land when it is sold. Valued biodiversity is now an explicit economic liability to land with development potential. In these circumstances, land with rich biodiversity in theory becomes less developable as it becomes more expensive to do so. Such is the avowed goal of early offsetting design originating from innovations such as the Safe Harbour Principle, which I discussed in chapter 4. At the same time, this land (and its embedded

biodiversity) is envisaged to become an economic asset for which landowners are incentivised to cultivate so as to tap into income streams from producing and selling biodiversity credits as a form or rent (such as the habitat banks discussed in chapter 5). There are huge divergences in market values between the sale of biodiversity credits under offsetting and the windfalls expected from the sale of development land. It is unclear, therefore, how BDO will not create potent perverse incentives for developers and landowners to deliberately destroy habitats so as to mitigate the reduction in land value the biodiversity would signal. This activity is already a very real feature of the development-conservation nexus and a strategy developers employ to hasten obtaining planning permission. One LPA officer told me in this case study, 'there is nothing we can do about that' (LPA2-SD 240216). Thus without addressing the broader dynamics of land valuation and markets in England, BDO will likely exacerbate an existing flaw in the planning system[26].

Furthermore, rendering biodiversity economically valuable simply subsumes it to the wider dynamics of land and housing markets. Both the landowner and developer's expectations of profitability mean that biodiversity offset considerations become yet another compensation liability, which throws habitat mitigation into conflict with affordable housing (or any other social good stipulated by the council as a planning condition). The economic conditions of land in England are such that it is being treated increasingly as a financial asset and one subject to 'banking' in line with the rapid appreciation of equally financially driven housing bubbles, pushing up land prices and ostensibly squeezing developer's margins. Without acknowledging this broader political economic reality of the use, exchange, valuation and financialisation of land in England, it is hard to see how 'tinkering with scraps at the end of the process' in attributing economic value to habitats will have the desired effects. Indeed it is likely to have exactly the opposite effect, as developers and landowners find new ways of minimising costs and maximising profitability, which would not bode well for biodiversity. Arguably if a rejuvenation of biodiversity conservation in England really is about 'making space for nature', much closer attention needs to be paid to land economy. This tension of BDO

[26] Paradoxically, there is also increasing evidence that it is precisely the speculative nature of land markets in England that is contributing to the housing crisis rather than 'blockages in the planning system'. Through land banking developers keep demand artificially high through limiting the number of dwellings they build (Ryan Collins et al. 2017).

alone is worthy of potentially another doctorate sized investigation and is surely a fruitful avenue for further investigation.

In summary, the many elements of this pilot site that either resisted BDO gaining much of a foothold or bound BDO to other extant assemblages (conservation, land markets) further illustrates how the practices of valuation through BDO depend on a diverse array of capacities, knowledges and existing arrangements. Context matters to the processes of valuing biodiversity and this chapter has shown how the context shaped the values that such practices produce. As we are beginning to see more clearly, biodiversity values do not just exist *a priori*, waiting to be captured with calculative devices or the correct economic incentives. People and things and the circumstances in which they operate shape and produce these values. The specificity of these assemblages has material effects and therefore consequences for conservation outcomes, both in the short and most probably the long term.

The next chapter continues with the themes of contingency and performativity but shifts the context radically in considering the voluntary corporate offsetting under the Thameslink Programme. In the following case study, we will get a closer look at the actual delivery of the habitat in conjunction with an offset arrangement. Unlike the LPA experiences in the pilot, TLP was able to (and driven to) fast track arrangements to locate and initiate an offset provider. Staying with the analytic of assemblage I highlight various significant implications arising from a growing uptake of NNL in corporate sustainability agendas in England and elsewhere.

CHAPTER 7
VOLUNTARY 'NO NET LOSS' AND CORPORATE SOCIAL RESPONSIBILITY: BIODIVERSITY OFFSETTING WITHIN THE THAMESLINK PROGRAMME

7.1 Introduction

Throughout the previous two chapters, I have traced the in situ attempts to use BDO in the English planning system. In so doing I have illustrated the ways in which biodiversity habitats are transformed into exchangeable commodities for trading and the broader shifts in conservation arrangements within planning processes that this is engendering. Throughout these empirical accounts, I have continually emphasised how, as a fundamentally social exercise, the wider social, political and institutional contexts of valuation dramatically shape the way that calculations are enacted in practice. I have shown how the production of values to stimulate trades of environmental loss for gain is a process that is frequently concerned with striking the right balance of values according to wider priorities for development, expediency or existing dominant conservation assemblages. The example presented throughout this chapter is also consistent with this finding.

The final case study of BDO within this research project into valuing nature under the DEFRA pilot is distinct from the prior two in that it derives from a voluntary initiative undertaken by Network Rail on the Thameslink Programme (TLP) rail construction project. Network Rail initiated biodiversity offsetting as part of its 'corporate strategy', seeking to meet sustainability goals in their corporate responsibility agenda. The move to offsetting was therefore neither related to regulatory compliance nor conditional for planning permission from the LPA. The chapter opens by briefly explaining the case study context and outlining how the practice of BDO and a corporate standard of NNL (quickly elevated to biodiversity net gain) came about at TLP, propelling it to become DEFRA's official pilot demonstration project within the complementary arm of the study. After this introductory section, the chapter explores how actors actively managed tensions and polarising value systems intrinsic to the objective of reconciling business values with biodiversity values. This section traces some of the discursive strategies that the key actors used as a means for achieving such compromises between the market-green value systems (Boltanski and Thévenot 1999), which also included the use of

imagery and graphical representations. Justification and legitimation are thus overt themes woven throughout the chapter. In particular, the chapter focuses on how different justificatory narratives were mobilised for different audiences. Audiences were both internal to Network Rail, and the wider epistemic and professional communities external to the organisation. And yet, the chapter shows how the narratives of legitimation and justification in an organisational context are also entangled with personal convictions, professional ambitions and the construction of certain corporate subjectivities of those enacting the processes. The chapter therefore sets up a discussion over the individual agencies of actors involved with the practical realities of enacting BDO in preparation for the next chapter that explores the BDO dispute. The chapter highlights how the production of new corporate-environmental subjectivities is central to the realisation of BDO in corporate settings and sets the scene for chapter 8 that draws from the pragmatic sociology of critique in consideration of how actors try to make sense of what is 'just'.

After exploring the ways in which market-green compromises (Nyberg and White 2013) are established in enactments of BDO, the chapter moves on to explore a specific offset contract as it played out. This section follows the structural format of the previous two case studies. In contrast to the prior two examples however, TLP actually managed to reach the point of financial transaction for compensation and subsequently initiated tree planting and woodland management as offsite biodiversity compensation. For this reason, a large focus of this chapter is on the pragmatics of securing and undertaking conservation at the receptor site. Through tracing this process, I discuss various practical features and difficulties of the arrangements. These issues related to the site selected for the offset's provision of units, reconfigurations to conservation's institutional arrangements including the repositioning of conservation NGOs, practical problems with certifying 'additionality' and features that are characteristic of the self-regulation that a voluntary programme entails.

In uncovering these themes from the data, the chapter closes by expanding the discussion of each and reflecting on their implications for the spread of BDO imaginaries and the performance of 'success' in other corporate voluntary BDO contexts around the world. One of the central implications for the developments of Network Rail's commitment to offsetting is its capacity to normalise and further naturalise the offsetting trajectories over alternative courses for action. In so doing, BDO locks in its substantive logics and frames of both conservation and nature (Apostolopoulou and

Adams 2017). Indeed, while much of the recent scholarship from academia and activist circles concerning the neoliberalisation of conservation generally and BDO specifically has focussed on empirical examples from the global south, much less has been written about actually existing empirical examples in the global north (although see Pawliczek and Sullivan 2011, Dauguet 2013, Apostolopoulou 2016, Sullivan 2013b). This case study finds that although the social, political and ecological circumstances are different, critical scholarship on the neoliberalisation of conservation is still relevant and applicable to this new context, even if there are some divergences.

Furthermore, to supplement the fruits from this analysis, I situate the theoretical lens of the neoliberalisation of conservation discussed in chapter 2, with the analytic of assemblage, to show how offsetting as a governance approach, its calculative devices, and the broader imaginaries of NNL are assembled through mutually circular strategies of legitimation across scales and geographies. The latter analytical accounts for how a local, anecdotal case study in London bears relevance to global circuits and networks of NNL and BDO through networks of individuals and organisations, financial flows and narratives pertaining to the 'offset ideology' (Seagle 2012). In so far as there is a 'global BDO assemblage' then TLP came to occupy an important node within this.

Thus, as much as this case study is about the actual material trajectories of an offset in action, I close by drawing attention to the ways in which the realities of the offset detailed contrast with the public representations of it. The disjuncture between performance and reality in the production of spectacle (Igoe 2010) comprises its own legitimation strategy through 'selling success' (Büscher 2014). However, it also parallels the disjunctive tendencies of offsetting, which can cleave open a space between the abstracted representation of biodiversity gains and actual material natures through the production of fictitious conservation (Büscher 2013) with 'paper offsets' (Quétier et al. 2014).

7.2 Case study context

The Thameslink Programme (TLP) initiated biodiversity offsetting in the summer of 2013 long after both the actual TLP works and the DEFRA pilot study had begun. Unlike the other private sector complementary pilots exploring the use of the metric on retrospective hypothetical studies, TLP were undertaking an actual project to offset impacts of their rail infrastructure developments. As such, TLP was awarded the status of a 'DEFRA demonstration project' with the view that its scale and profile could assist with

assessing offsetting's potential for public-private sector development in England[27]. The key actors involved were the Environment Manager at TLP (denoted as DEV-TLP), their consultant ecologist (formerly at Parsons Brinkerhoff and now with Balfour Beatty: CE-TLP), the offset delivery partners (London Wildlife Trust in partnership with Lambeth Council, NGO1-TLP and LPA1-TLP) and local residents (LR-TLP) within the Friends and cooperative groups associated with two of the London parks designated as offset sites.

The Thameslink Programme (henceforth TLP) is one of three of Network Rail's initiatives. The other two consist of Cross Rail and the Maintenance and Special Delivery Service. At the time of research, TLP was the largest rail infrastructure project in England undertaking extensive upgrading to the service by expanding stations that are compatible with longer and more frequent trains on a track that runs from Bedford to Brighton through central London on the UK's busiest and most congested commuter routes. The twelve-year project operates with a budget of £4.6 billion. It started in 2006 when the TLP was awarded planning permission under the Transport and Work Act (TWA) Order.

Objectives and higher structuring values

The unique context of TLP BDO was that it was a voluntary as opposed to a compliance engagement. The personal and professional *values* of the main actors along with the wider institutional and organisational setting of this voluntary case study are therefore distinct to the ones at play within residential LPA applications in chapters 5 and 6. For these reasons, the TLP case study provides important inferences for other private, corporate social responsibility (CSR) voluntary biodiversity offsetting initiatives across infrastructure and extractive industries in England.

Looking to exceed its legal obligations to biodiversity, TLP set itself a more ambitious sustainability strategy and developed 'corporate drivers that feed into that' (DEV-TLP 010813). In this respect, TLP's sustainability strategy is framed as 'delivering transport benefits to budget that represent value for money and creating an overall positive effect

[27] Upon winning the election, the Conservative-Liberal Democrat Coalition Government announced the UK's new infrastructure plan setting out over £200 billion worth of public and private investment as part of the economic recovery programme following the global financial crisis in 2008. Major transport investments made up a considerable part of this figure, including proposals for the environmentally and politically controversial High Speed 2 rail line, as well as £14 billion of public investment in Network Rail (HM Treasury et al. 2010).

on the community and the environment' (TLP Sustainability Development Policy cited by the BOMP 2015). Within this vision, the firm developed twenty sustainability objectives, of which one committed to 'maintain and enhance biodiversity' (TLP Sustainability Strategy cited by the TLP BOMP 2015)[28]. In addition to this framework and as part of the Thameslink commitment to sustainable development, the Programme set itself a target to 'enhance its habitat footprint to achieve a net biodiversity gain via the mitigation hierarchy in line with The TLP's Delivering Biodiversity Benefits Policy' *(*TLP Biodiversity Policy cited by the TLP BOMP 2015).

Embracing a target for 'net gain' came about directly due to the strengthening of a professional partnership between DEV-TLP and CE-TLP. The consultant ecologist was already leading on the Balfour Beatty complementary pilot and fell into conversation with TLP by coincidence in 2013. CE-TLP described what she was doing at Balfour Beatty with the broader DEFRA pilot and was subsequently 'invited to come and talk it through with [TLP], and the conversation started that way' (CE-TLP 010813). DEV-TLP (010813) reported 'we had a discussion about biodiversity, she mentioned this calculation that DEFRA had so we decided to try it on Thameslink.' Such chance encounters are consistent with the discussion in chapter 2 in respect to the ad hoc and frequently serendipitous nature of developments that enable the circulation and stabilisation of NNL into policy standards and practices.

By this time CE-TLP was leaving Chris Britton Consultancy but carried the partnership with TLP over to a new role at Parsons Brinckerhoff, a global engineering professional services firm and another subsidiary of Balfour Beatty. So as to meet the requirements of the NNL and the net gain goal, the metric was required to quantify losses and gains; DEV-TLP informed me; 'I think the issue we had when we set ourselves the target of no net loss there was nothing to measure it, so we said OK we'll go for no net loss but what does that actually mean to calculate in reality?' (DEV-TLP 010813). TLP commissioned Parsons Brinckerhoff to use the metric for calculating the biodiversity unit loss at each of the development sites along the rail route. Together, they decided to meet a no net loss target, however, upon realising they couldn't replace all of the loss within the 'Network' they said 'offsetting came in' (CE-TLP 010813).

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[28] The TLP Sustainable Development Policy, Sustainability Strategy, Biodiversity Policy and Biodiversity Procedure are referenced in the 2015 Biodiversity Offset Management Plan but the year is not included and these are not publicly available documents.

The partnership between these two professionals proved to be a productive collaboration that featured prominently in the development of BDO under TLP and the DEFRA pilot study. TLP was named as the only official demonstration project for the DEFRA pilot and by the end of 2014, BDO was subsequently being prepared for 'roll out' across the other programmes across the whole of Network Rail (CE-TLP 261114). The professional collaboration resembled the accidental assemblages of Warwickshire where a new brokerage firm with unique attributes and resources had been enrolled into the BDO 'network' through chance conversations. Thus, what had been originally born out of a spontaneous encounter subsequently sparked a long-standing organisational collaboration between two individuals and their organisations.

These two professionals were independently pioneering BDO within their respective organisations and as such, their separate endeavours were strengthened through this collaboration. The working relationship was reinforced by overlapping professional networks and interests as well as through a convivial and productive working relationship, as two people 'on a mission'. This ambition extended beyond the confines of Network Rail. Even from the early stages DEV-TLP had expressed personally held conviction that BDO offered the solution for all development related impacts on biodiversity. For example, at the BBOP BDO summit in June 2014, DEV-TLP said that the 'key goal for TLP was to formalise no net loss and a net gain approach in the *English planning system*' (emphasis added). Similarly, during a BBOP community of practice webinar, DEV-TLP conceded that the work was driven by personal as well as professional commitments. As TLP was a publically funded infrastructure initiative, she explained, there were therefore strong grounds for exceeding legal compliance (TLP 171115). The normative convictions driving the adoption of BDO and NNL at TLP also therefore came to play a role in the assemblage.

Assessing the 'costs and benefits' of undertaking the approach

At the same time as making the moral argument for corporate sustainability objectives framed around delivering a 'net gain' for biodiversity, these actors consistently also justified BDO as a 'business solution'. The 'business case' was repeatedly emphasised, aligning narratives based on mutual sustainability and corporate strategic objectives. Such alignments (Li 2007a) mirror the stabilisation of green compromises discussed throughout this thesis and expanded in the summary section and in the next chapter. Both DEV-TLP and CE-TLP worked hard to maintain the right balance of justificatory narratives so as to uphold BDO's legitimacy in the eyes of senior actors at TLP. For

example, the project would certainly cost the company more money than a 'business as usual approach' [29]. Part of the rationalisation for this additional investment in biodiversity, therefore, was the profile and industry leader status that it might earn. The widespread negative press that BDO was attracting generally nevertheless, frustrated TLP's ability to frame the approach as a progressive initiative and threatened the environmental justification on which it was based. For example, DEV-TLP described the process as a 'journey', implying that there had been some unexpected twists. Specifically, this referred to the negative media coverage BDO was attracting. In addition, there was a growing contestation from civil society campaign groups such as Friends of the Earth, Fern International and Save Our Woods. In October 2014, these groups had written an open letter signed by 67 organisations and 9000 people to Janez Potočnik, European Commissioner for the Environment in relation to the EU's consultation on NNL. The message of the letter was to 'Say no to biodiversity offsetting' (Lang 2014). The Ends Report, a specialist publication for environmental professionals issued articles with titles such as 'Rush to biodiversity offsetting 'massively premature' (Evans 2013) and 'Biodiversity offsetting attracts local opposition' (Marshall 2013). [30] During our first interview in 2013, DEV-TLP held up a photocopy of a Guardian newspaper clipping of a piece written by George Monbiot entitled '*Unleashing the spirit of destruction across the countryside*' and told me that:

> as a business we are very conscious we don't want the approach we are taking to be deemed as negative as we have been very clear about why we are doing this. It's not so we can go in and build what we like and then just offset, it's very much a business solution for us. So we spent a lot of time going away thinking about what is the best way to structure this to ensure we were doing everything we possibly have do to comply with legislation, and we were being as

[29] There are additional financial and management costs to offsetting since it entails going above and beyond customary biodiversity appraisals and compensation arrangements and in the short term; transition costs associated with installing new management systems and corporate standards. For example TLP undertook management changes to train some 500 staff with BDO habitat classification procedures and 'robust processes' so that in their words 'when an engineer or construction management or designer looks at an area of the site they have to go through a list of tick boxes to make sure they have followed the rules' (DEV-TLP Aug 2013).

> transparent as we could be with our stakeholders and not introducing negative publicity with the scheme that we're doing. (DEV-TLP 010813).

With their own professional reputations at stake, DEV-TLP and CE-TLP were required to navigate the tensions between the public criticism that BDO would fast become a 'license to trash' and the stated business rationale for taking part. DEV-TLP frequently said, 'it's a business solution for us' deliberately aligning the proposed future business benefits along with the authenticity of TLP's interest in being an ecologically conscientious developer. The business solution is framed as 'delivering our strategy and our commitments to biodiversity' but also 'reducing our risk as we can measure it so we know what we need to replace' (DEV-TLP 010813). The business case tended to be consistently and seamlessly conflated with a moral imperative and environmental rationale. CE-TLP told me that since their approach was unrelated to planning because they already had permission 'it is purely driven by us wanting to be more sustainable and deliver that'. She reiterates:

> Thameslink are different, you know they are striving for excellence; they are striving to do something sustainable for the long term, not scraping the barrel and doing the bare minimum. For them it is an investment for what drives their business. (CE-TLP 010813)

While the statement 'an investment that drives the business' is ambiguous, it does illustrate the discursive alignments appearing as powerful compromises between separate and historically conflicted agendas (Li 2007a). As such BDO was re-named *Delivering Biodiversity Benefits* to maintain a commitment to its perceived environmental advantages yet distance the programme from the controversy of the approach. DEV-TLP tells me; 'it's part of the solution, it's part of the mitigation hierarchy' (DEV-TLP 010813).

Another part of this business case was related to achieving a 'return on investment' following the committing of resources and organisational time to pilot BDO. Partly this return would be underpinned by a strong public relations (PR) programme of external communications. This PR and public engagement was partly damage limitation to the public criticism BDO was coming under (described above) and partly wider promotion of the programme to a growing epistemic professional community. TLP wished to be seen to be an industry front-runner and leader in corporate sustainability to both the construction but also the wider ecology sector. Towards the close of the official DEFRA

pilot period at the end of 2013, TLP started speaking widely to industry and ecology professional communities: 'as we want to be completely transparent, as we don't have anything to hide' (DEV-TLP 010813). They used their status as DEFRA official demonstration project to actively engage the burgeoning BDO professional network by speaking at BDO relevant events at Construction Industry Research and Information Association (CIREA), as well as to ecology professionals at the Institute of Environmental Management and Assessment (IEMA). In addition, DEV-TLP and CE-TLP became active within BBOP and Forest Trends events, appearing as panellists in the 2014 London summit along with other Community of Practice webinars in 2014, 2016 and 2017. The two professionals widely promoted their work using BDO on the infrastructure project through industry magazines press releases. The international newsletter *MitMail* run by Forest Trends and internal communications publications for the global community Parsons Brinkahoff, as well as many others, all featured accounts of this increasingly iconic programme. In particular, public documents drew on the potent image of DEFRA Secretary of State Owen Paterson, wielding a spade and digging the ground at the offset site in February 2014 within 'London's first biodiversity offset' (Figure 17).

Figure 17 DEFRA minister launching London's first biodiversity offset with Network Rail and London Wildlife Trust

Source: Construction News[31]

The public communications tended to foreground critique so as to confront and counter this. TLP's strategy of legitimation entailed emphasising strict observance of the mitigation hierarchy and the inherent pragmatism of BDO as an approach to tackle residual losses resulting from essential infrastructure development.

However, it became increasingly necessary to also direct these messages internally to TLP to obtain 'senior buy in and leadership from the top' of Network Rail. DEV-TLP and CE-TLP described how quantification methodologies help to overcome the perception of undertaking corporate biodiversity 'best practice' as a business cost through making it transparent to decision markers and building it into the budget. This much was reiterated in the official DEFRA evaluation project's assessment of TLP stating:

> Engagement of the TLP Executive Board was critical. This was facilitated by changing the way biodiversity is communicated to a business audience.

[31]https://www.constructionnews.co.uk/companies/sustainablebusiness/thameslink-upgrade-uses-offsetting-to-boost-biodiversity/8658417.article (Accessed 15th June 2016)

> Unavoidable loss of biodiversity and the roadmap for a net-gain was illustrated in numeric scores, by using the Defra metric, from which the Executive Board could more easily make the commitment to a net gain. (Baker et al. 2014b: 2)

However, CE-TLP also acknowledged that while numbers helped to enrol the Board, there were limitations to this approach indicating that there is a time and place when numbers were necessary to achieve certain things. CE-TLP emphasised that professional ecological expert judgements must always guide how the numbers are applied in practice. She stressed '[N]umbers are useful management tools' but only 'effective after *understanding* biodiversity' (emphasis added) (CE-TLP 010813). The distinction between purely technical justifications and nuanced professional judgments is yet another tension these actors navigated. The logic of 'horses for courses' (NE1 150613) demands the instrumentalised translation of knowledges into audience friendly formats. This facet reflects a mere microcosm of the wider institutional tensions the DEFRA metric creates and the directions it is pulling conservation practice and theory.

In summary, efforts to establish TLP in a voluntary context required internal persuasive advocates to steer a course through a range of polarising tensions. These included the need to appeal to the interests of senior TLP management (necessitating simple, friendly and compelling communications) as well as mitigating reputational risk factors and maintaining a strong public programme of engagement. Significant for TLP's role in the assemblages of BDO more widely is that its reach through organisational influences and PR channels is potentially enormous. The two individuals comprising this collaboration are situated in expansive corporations with considerable networks in the infrastructure and ecology sectors more widely in the UK and internationally. Furthermore, Network Rail is the fourth biggest landowner in England owning over 30,000 hectares of land including Sites of Special Scientific Interest (SSSI), Areas of Outstanding Natural Beauty (AONB) and many other statutory and locally designated nature reserves (Beneke 2014) meaning that it would not be surprising if it engaged with providing the offsets itself or to other developers. Network Rail is also one of the biggest infrastructure bodies in the UK and joined BBOP as a member in 2015. Balfour Beatty disposed of Parsons Brinkahoff in 2014, but CE-TLP took up a new role as Biodiversity Technical Specialist at the parent company with a focus on delivering biodiversity offsetting on major infrastructure projects. Balfour Beatty is a British plc. with over 36,000 staff operating across the UK, North America, Canada and South East Asia. Ripple effects in both of these organisations

could see exponential uptake as the language, standards and expertise is developed across new projects and consensus stabilises.

7.3 The biodiversity offset

The development

TLP development work consists of two 'key outputs'. The first entailed the construction and significant expansion of London Bridge and Farringdon stations. The second, and to which the biodiversity impacts were recorded and compensation sought, involved a massive upgrading of track and signalling equipment along the length of the Thameslink route from Bedford to Brighton. The bulk of this work involved building new depots and stabling sites as well as installing new railway sidings to house the trains overnight. As with many infrastructure projects, a significant proportion of the construction and associated environmental disturbance was necessary only for temporary works that facilitated another part of the development.

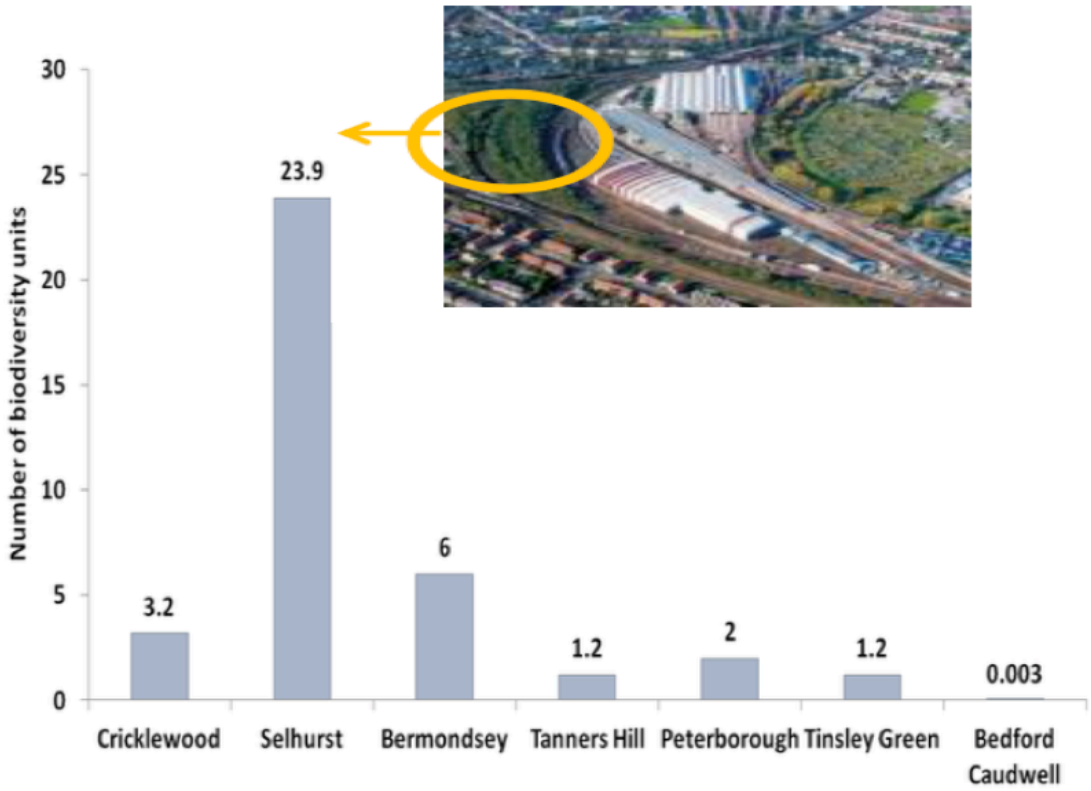
Calculating the impacts

Seven sites along the TLP route showed biodiversity losses with an initial total loss of 48.9 units (DEV-TLP 010813) (Figure 18). For unclear reasons, this sum was later downwards recalculated to be 42 units (BOMP 2015)[32]. Forty-two units therefore required compensation and a 'net gain' in terms of unit delivery at an offset site. Of the seven sites with biodiversity loss along the route, the one with the highest recorded impact was at a site called Selhurst, located just outside a railway station in south London. Here, an area of rail locked silver birch woodland was cleared to make space for temporary railway sidings for over-night train storage while London Bridge station was being upgraded. The baseline and loss calculations undertaken by CE-TLP showed that Selhurst unit losses totalled 23.9 units (CE-TLP 201113) of a baseline value of 24 units. The development needed to remove 99 per cent of the woodland at this site. Onsite replacement was impossible due to an absence of space or land around the rail tracks and wider urban fabric in which it was embedded. Since woodland habitat comprised the greatest loss in terms of units, TLP sought a 'like for like' offset made up of woodland to reflect the Selhurst impacts. Aggregating the calculations of residual loss from the other sites along the TLP route provided the total number of units making up the biodiversity loss. For

[32] Unlike the local planning authority case studies in chapters 5 and 6, I was not able to obtain specific details about how this impact was downwards calculated.

the most part, these impacts were predominantly associated with habitats awarded low distinctiveness and poor condition (DEV-TLP 010813) from relatively marginal, brownfield urban sites.

Figure 18 'Impacted biodiversity units as a 'statistical picturing device' used in public communications



Source: TLP Presentation to CIEEM 15th November 2014

Central to the challenge of using the DEFRA metric on a multi sited project was the necessity of training the many different ecological consultants to perform calculations. For this purpose, CE-TLP made a 'translation spread sheet' to convert the conventional Phase 1 habitat classifications into the DEFRA metric categories and values so as to produce consistent and uniform results (CE-TLP BBOP webinar 191115). In contrast to the translations underway at Warwickshire, where the Environment Bank broker provided training seminars for ecologists, at TLP, a spread sheet device enabled this knowledge conversion. Amongst other difficult translation processes, TLP discovered that the habitat condition assessment methodologies of the Farm Environment Plan (FEP) proposed in the DEFRA guidance (discussed in chapter 4) were broadly shaped around agri-environment schemes and were not therefore relevant to urban contexts. The FEP was in CE-TLP's words 'clunky and clearly written by people who spend a lot of time in the country-side' (CE-TLP 201113).

TLP emphasised that they 'always follow the rules, the first of which is the mitigation hierarchy' (DEV-TLP 010813). For TLP, mitigation had included where possible and

practical, the relocation of sub stations to avoid the removal of vegetation or disturbance protected species. In these cases, the legal compliance always comes first meaning they must follow statutory wildlife legislation for protected species (DEV-TLP 010813). Although, the provision of on-site enhancements is central to the mitigation hierarchy, it was not always appropriate for the railway environment. CE-TLP was keen to counter the notion that on-site mitigation is always preferable:

> Sorry to butt in, but you know sometimes it doesn't make sense if you are going to do something that is useful for biodiversity, I just think it's wrong to encourage animals right next to a railway line. The best you can do is put back something interesting like wildflowers or native species but if you're really going to create good woodland habitat that something like dormice are going to use, don't put it next to a railway line! It's just going to be disturbed. The amount of vandalism and the amount of rubbish that builds up along railway lines… you know you have to put it somewhere decent. (CE-TLP 010813).

In addition, the railway context of the TLP construction meant that there were also health and safety issues associated with woodland proximity to the track so that offsetting is put forward as a unique solution to the railway environment because:

> You can't physically re-plant along the railway line and if you did the first thing that would happen is that people would complain when there are leaves on the line! And the train stops running, the place is filled with rubbish and with animals on the line… it's horrible! (CE-TLP 010813).

On site enhancements that follow the mitigation hierarchy are further compromised by the probable future expansion of the railways, reaffirming the idea that, in this context the mitigation hierarchy and onsite replacements may be better evaluated on a case by case basis and potentially skipped altogether in favour of offsite offsetting.

Offset partners for the delivery of the sites

By the Autumn of 2013 TLP had managed to secure an offset delivery partner in the London Wildlife Trust (LWT). Prior to this agreement however TLP had been talking to other conservation bodies, including the Woodland Trust. The Woodland Trust, however, was not prepared to publicly state that they were participating in the TLP offsetting project. Yet, this was a key criterion for the partnership, due to the publicity surrounding the DEFRA demonstration project. The LWT came forward in the end 'with their house in order' over offsetting realising they 'can't sit on the fence' (DEV-TLP

201113). DEV-TLP (201113) said that the Wildlife Trust 'could see the benefits of it for their organisation as well as ours'. In respect to brokers, TLP preferred not to use the Environment Bank, but instead a conservation partner that they considered to be a 'well established' body that 'will have the experience' they needed for the approach to remain squeaky clean (DEV-TLP 010813). TLP were further discouraged from partnering with the organisation as they considered this might be taken to be an indication they were dispensing of their responsibility. DEV-TLP said:

> We wanted it to be about biodiversity rather than putting money into the bank, and that being perceived as negative, so not putting a cheque to the problem but actually delivering it with a partner. (DEV-TLP 010813)

In relation to the particular legitimisation strategies emphasising the moral imperative of BDO, TLP were focussed on engaging with biodiversity as a cause, and this was not felt to be complementary with a third-party bank/brokerage entity that cleans up the problem for a fee. Limiting the process to financial compensation was deemed to be open to criticism of green-washing the development instead of a genuine commitment to corporate sustainability and delivering a 'net gain' for biodiversity. At the same time, value was identified in the prospect of undertaking the actual conservation work in-house as TLP positioned BDO as an opportunity for staff engagement. For TLP, choosing their own offset partner was essential to this latter point:

> What Thameslink has been really strong on is that they want staff engagement so they want the staff to go out and help the planters, and you don't get that if you give a cheque to someone. (CE-TLP 010813)

Spatial tensions

Like the other case studies from prior chapters, TLP encountered problems with identifying receptor sites. The company wanted the offset to be as close to the impacts as possible. However, as the biodiversity loss derived from several different sites, it was not practical to achieve this. Furthermore, TLP felt there was 'bigger bang for buck' in delivering an offset in London. In partnering with the London Wildlife Trust, the TLP offset was to align with the LWT's existing Great North Wood (GNW) Living Landscape strategy, through delivering woodland enhancements and planting schemes along key sites of the historic London wood. The London Wildlife Trust presented TLP with three different offset types. CE-TLP took these and; 'drilled down to work out how much it

cost per biodiversity unit, to really start to look at what presents value for money for the developer' (CE-TLP 201113).

The first land LWT offered TLP was the NGO's strong preference since it was under their own control and the most feasible option within a wider context of 'highly contested' (NGO-TLP 270116) and heavily used parcels of land in London. Putting this conservation opportunity forward, the LWT envisaged a simple and non-controversial management programme on a well-identified conservation priority that simply had a funding shortage. This proposal would entail some management of woodland at Dulwich Wood, a site 'not too far away from the actual impact' (NGO-TLP 270116). All the same, TLP rejected this option because they had a 'corporate wish to be able to show something on the ground - a fundamental change' (NGO-TLP 270116). Furthermore, this option didn't offer the right number of units and in the CE-TLP's own words 'was not good value for money' (Nov 2013) (see Table 10). CE-TLP said:

> there was one site where most of the offset was going to be enhancements, they weren't planting anything new which immediately lowered the number of units you could get by default, as enhancing you are not going to generate as many units as you are if you are creating something, you know planting new habitat. And the number of units for that were quite extortionate and at the end of the line, for BDO to work the developer has got to look at it and it has got to make economic sense. (CE-TLP 201113)

Table 10 Example of biodiversity offset options assessed as value for money

Proposal	Woodland Offset	Total Cost	Total BD units	Cost per BD unit
Streatham Common	Creation	£18,800	12.96	£1,451
	Enhancement	£29,200	19.20	£1,521
Brockwell Park	Creation	£31,700	11.58	£2,737
	Enhancement	£17,300	2.36	£7,339
Dulwich Wood	Enhancement	£48,500	2.40	£20,208

Source: Author adapted from slides in the Network Rail BBOP webinar July 2014

Since the woodland enhancements were unable to offer value for money, the drive was thus towards woodland creation and actual tree planting. It has been suggested elsewhere that another reason for TLP rejecting this site for the offset was that it would be 'invisible to the public' (NGO-TLP 270116). The TLP did not consider enhancements

to an existing, privately owned wood to be appropriate nor represent enough of a change or a contribution or to be visible enough for the demonstration of the project. TLP considered it better to do 'one big central offset rather than little offsets dotted around 'because you will get the maximum biodiversity from that' (CE-TLP 010813). But this would also ensure maximum visibility. TLP required a prominent offsetting case study to which to refer in public engagement efforts. In the absence of any in-house nature reserve options for the desired scheme, the London Wildlife Trust was pushed toward securing a site that was not under their own control. Streatham Common, a Lambeth Council park but also a Local Nature Reserve was eventually put forward for this woodland planting. Although my data collection did not identify the reasons why Streatham was selected, a plausible link was the existing professional connection between an individual here acting as Head of Parks and Green Spaces at Lambeth Council and the London Wildlife Trust, where this individual was also acting as a director (LR-TLP July 2016) until 2014 November (Companies House 2016)[33].

Due to its status as the DEFRA demonstration project, DEV-TLP (261114) told me the whole process 'moved quite quickly'. The value of being named the demonstration project carried weight in a way that legitimised the project in the eyes of senior executives but it subsequently allowed relatively little time to extensively scope out the partners, the nature of the offset delivery locations and any political complexities that may be relevant to these (NGO-TLP 270116). This time pressure had knock on effects, one of which was the rapid selection of Streatham Common, which was not properly assessed in terms of its suitability and later heavily contested by the local community, as I expand on below. As such, the imperative for haste also threw the programme out of kilter with TLP's aspirations for a 'community partnership model'. The downstream difficulties of these guiding criteria for the type and value for money of offset required, and the speed in which it was delivered, strongly influenced how the offset played out and most likely its prospects for long term conservation success.

The London Wildlife Trust supplied the TLP with a proposed conservation management scheme at Streatham Common comprising seven different parcels of woodland planting and management. CE-TLP subsequently worked through this proposal so as to calculate

[33] The professional networks continue to open up doors for engagement as this individual is the vice chairman of the Association of Local Government Ecologists (ALGE) and coordinated its November 2016 annual conference at which CE-TLP delivered one of the eight presentations during the day long meeting entitled *Net Gain for Biodiversity - New Principles and Guidance*.

the available units that each parcel could provide. Although these seven parcels would supply ample units as a quantitative increase to the impacted units, when the metric multipliers were applied, 'around 50 per cent of these were lost' (CE-TLP 201113) (see also discussion of metric technicalities in chapter 4). In selecting which risk category the multipliers should fall under, the TLP consultant ecologist said that the 'difficulty' and 'spatial multipliers' were 'quite easy to do' since the offset delivery partner was a trusted conservation agency and the location is strategically placed within the Great North Wood. The offset would therefore fall within an existing regional biodiversity strategy and be undertaken by an experienced provider. However, after applying the time risk factor multipliers, the number of units available at Streatham Common were drastically reduced. The basis of selecting the likely 'time to reach target condition' was assessed on a precautionary principle according to the existing recreational uses of the park since:

> time to target condition, especially if it is an urban site we wanted to err on the side of caution because risk of failure if there is a lot of dog walkers and things like that the risk is possibly higher and we didn't want anything that people could tear apart our calculations. (CE-TLP 201113).

Due to the 'de-valuation' of Streatham's biodiversity unit budget, other sites were needed to make up the unit shortfall. Brockwell Park, also within the London borough of Lambeth was put forward as a second site. Eventually a third site called Ten Acre Wood in the north west of the city was required as well. Ten Acre Wood is located on the other side of London and not at all related to the Great North Wood Living Landscapes project. Although it provided just over half of the total units in compensation, Streatham Common is the only offset site that is represented within TLP's public engagement communications. Given the limitations on space here and the emphasis placed on Streatham by TLP, I have restricted my focus to this offset site only. Table 11 shows the distribution of biodiversity units to be delivered from each offset site.

Table 11 Spread of units to be delivered from offset each site

Offset site	Biodiversity Units
Streatham Common	38.13
Brockwell Park	5.9
Ten Acre Wood	28

Source: Biodiversity Offset Management Plan 2015

Receptor site: Streatham Common

Streatham Common is an important 24 ha green space in the London Borough of Lambeth, formerly on the fringes of the GNW. It is an open common with a mixture of mostly recreational acid grassland and young native woodland dating to the end of the 19th century. It contains an orchard called *The Rookery*, a Grade II listed and landscaped garden area with ornamental pond, streams and rock gardens as well as a café and community garden. Streatham Common contains one of the borough's largest areas of native woodland comprised mostly of oak, sycamore, beech, ash, hawthorn and elm. In 2013, just over half of Streatham Common, including parts of the Rookery were named a Local Nature Reserve by Lambeth Council.

The common was afforded this local status due to its local natural interest as well as community and educational value. The common is a heavily used recreational park and sits at the heart of a dynamic array of community user-management groups. The groups include the local residents groups: Friends of Streatham Common (FSC) and Streatham Common Cooperative, known as SCCoop, which formed in 2014. The Friends of Streatham Common are a registered charity run by local residents with about 350 members, who pay a token annual fee to receive newsletters and the opportunity to contribute to the charity. SCCoop became a separate legal entity in early 2014, so that it could receive monies to take over management of parts of the Local Nature Reserve (LR-TLP1 270716). A growing paucity of council resources meant the council could no longer manage the local Nature reserve, a point that I will return to later. Lambeth owned the site at the time of the BDO negotiations at the end of 2013 and beginning of 2014, but it was devolving the responsibility for the park management to SCCoop.

The London Wildlife Trust occupied a central position in the network of actors. Its role was to mediate between all of the other partners involved with the offset. The

distribution of responsibilities within the contract positioned Network Rail as funders of the offset, LWT as conservation managers for the first five years and Lambeth Council, as owners of the park assuming on-going habitat management thereafter. FSC did not have an explicit role other than acting as the local engagement partners with whom LWT consulted over their plans as to how the planting schemes would be designed. Along with the strategic priorities of the London Wildlife Trust for restoring parts of the Great North Wood, Lambeth Council sought to increase the wildlife opportunities in Streatham Common, thereby making the BDO an attractive addition to the existing agendas of both partners. The odd one out was the FSC, whose interests and concerns became increasingly misaligned with those of Network Rail and London Wildlife Trust (NGO-TLP 260116, LR-TLP 270716).

At the initial discussion in 2013 when the LWT consulted the FSC (LR-TLP) about BDO, the FSC representative (LR-TLP1) reported there 'wasn't much enthusiasm'. The FSC's nominated representative paraphrased the Friends' collective thoughts as 'well we've got lots of trees on this common, do we need anymore and if so, where do they go?' (LR-TLP1 270716). In parallel to the disinterest in increasing the wooded areas of the common, the LR-TLP felt that what they needed more than new trees was some real management work on the existing trees as the representative mentioned 'certainly as long as I remember, perhaps the last 10 years or so, tree management has consisted of cutting down any trees that were dangerous and clearing up any trees that fell'.

After LR-TLP1 had been 'tipped off' by the actor straddling roles in Lambeth Council and the LWT, and following some preparatory discussions, all parties, apart from Network Rail, walked around the common to discuss the proposed planting schemes and parcels that LWT had put forward. The management proposals for the existing trees on the common were eventually incorporated into the offset plans although LR-TLP1 was not clear whether this work was eventually going to count towards the official offset unit calculations. LR-TLP1 expected that LWT would send along some volunteers to do this work, which would be a customary procedure for the Wildlife Trust to undertake. He did wonder whether this management work had been included in the offset agreement as a way to 'sweeten' the FSC, given that they did not particularly desire the offset to happen in Streatham Common in the first place. There was no dialogue in relation to the specific number of units to be created, and LR-TLP1 had no contact with Network Rail at any time.

Entirely contrary to the explicit objectives of Network Rail, the process of getting the local Friends group involved with the project as accepting of the offset delivery let alone

in any kind of 'partnership' or 'engagement model', transpired to be one of on-going appeasement and persuasion with considerable 'horse trading' between parties (NGO1-TLP 260116). Some of this negotiation included LWT committing to providing management of the small orchard area used as public access and a demonstration plot but which wasn't 'strictly part of the offset' (NGO1-TLP 260116) in addition to a replacement cedar of Lebanon (*cedrus libani)* tree to make up a pair from one that was lost from the Rookery many years ago. The LWT were amenable to meeting these additional requests so as to navigate the multiple demands of stakeholders they were coordinating, since by this time the LWT found themselves caught in a knot of interests. This complexity included their obligations towards Lambeth Council policies, the desires and views of FSC as local residents and users of the common and their commercial contraction to TLP as clients for the delivery of the offset. Eventually FSC were encouraged that the new trees making up the offset would be a collection of distinct species to the majority of existing trees on the common and yielded (LR-TLP 270716).

Using a 'very rough map', the LWT and the lead actors from Lambeth Council and FSC informally agreed on where the new trees would be allocated. The initial round of planting commenced in February 2014 using LWT volunteers. However, after this first round, the project was paused in relation to complaints and resistance from the Friends group and other local users of the park who were not happy with the location of the trees (LR1-TLP 270716). Objections were based on the fact that the new trees would eventually mature to obscure the view of the park from residents' houses, (a personal objection from the Chair of the Friends group), as well as the specific planting arrangement along the perimeter of the park that was currently being used as a running circuit. People valued the openness of the common and used the space for running, football, community events such as a kite festival. The residents greatly appreciated the open expansive views over the Streatham Vale and feared the maturation of the additional trees that had been planted would eventually interfere with these landscape characteristics of the common. Fundamentally however, the FSC were bothered because, despite a proclaimed 'partnership' model, the offset was developing in un-predictable ways with new planting emerging in places that they hadn't been aware of. According to LR1-TLP, at this stage of the process, the complaints pointed out:

> that some of the planting was not according to the planning, as much as there wasn't a clearly defined plan…It was going to be in the area that was a bit contentious anyway and I couldn't see how it could have added up to seven

> hectares, which was never specified and I don't know where they got that area from or how much more there was to plant. (LR1-TLP 270716)

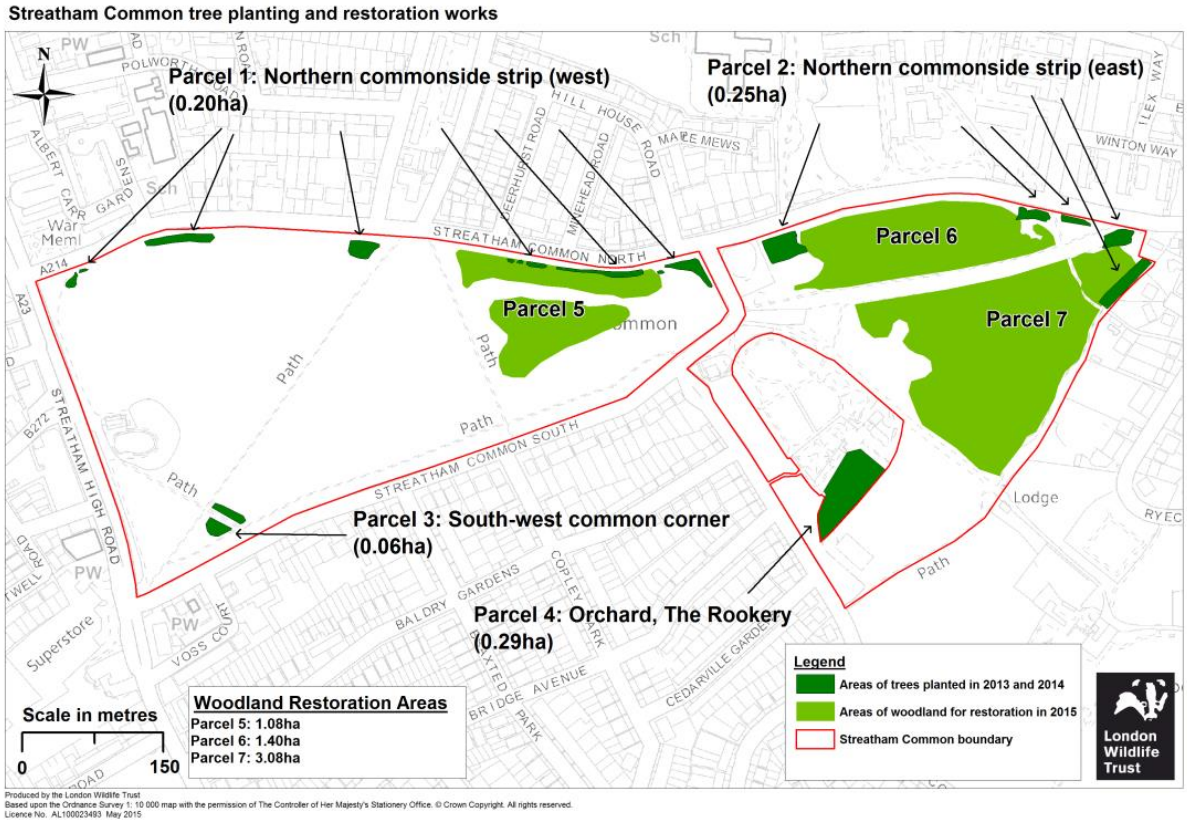
The FSC felt that the arrangement lacked a clear agreement on both sides about the location and the extent of the tree planting, such that when LWT came back to start the second phase of planting, the Friends largely refused on the grounds they hadn't anticipated more trees and in any case, there had been enough problems with the first round. While the LWT strongly felt that they had undertaken all of the necessary consultations and met the concerns of the local park users it wasn't until this first round of planting had been completed that they discovered 'the friends were not speaking with one voice!' (NGO-TLP 260116) The manager at the LWT told me:

> So even with the efforts made, it was still controversial. There's this whole issue where you can have the best discussions, long term consultation, draw a map, get agreement with people but when you are on site, somebody goes 'oh I didn't think you were going to do it there!' Land in London is highly contested, multiple uses, multiple interests. So even open public land which may be a park or an open space, on a map it looks easy but the reality is there are huge number of political issues - we discovered those! (NGO1-TLP 260116)

Eventually, much of this initial planting work had to be removed and incorporated into other parcels of the management scheme. By this stage, relations between parties at the offset site were becoming strained. LR1-TLP admits that it was surprising to him that the FSC had been afforded so much say in the process at all, since this should have really been the reserve of Lambeth Council as owners and managers of the park at the time, but 'they didn't seem to be involved in that' (LR1-TLP 270716). He wondered whether since the individual from Lambeth Council, that had made the introduction in the first place and who was also acting as a Trustee for the LWT, felt he had better stay out of things due to having interests in both parties (LR-TLP 260716). Over the course of the planting period and ensuing dispute in 2014, LR1-TLP reported that he had no contact at all with TLP and so did not know whether they were aware of the friction that was arising. In reference to their consultant ecologists, Parsons Brinckerhoff, he mentioned that he had noticed 'some mysterious third party putting out press releases'. One of the press releases reported that 10,000 trees were planted, which LR1-TLP strongly negated: 'well I don't know where 10,000 trees would have gone - that was nonsense!'. LR-TLP had counted them after the planting was finished in 2014 and he suggested, 'it was more like 700' (LR1-TLP 270716).

As mentioned above, one of the contributing factors that led to the planting dispute at Streatham Common was the timeframe that had been set to achieve an offset within. The LWT were familiar with the realities and difficulties of delivering on going habitat management under a spectrum of different legal, political and social contexts. For these reasons the LWT conservation officer charged with managing the offset relationship and project delivery suggested a five-year timeframe would be appropriate with the first year used for assessing site, ecological and social appraisals (NGO1-TLP 260116). This assessment period would entail the asking of questions such as 'who is using the site, who is responsible for it, what are the issues, how is it being used?' (ibid.). Anticipating these political issues is why the LWT initially encouraged TLP to follow an offset on one of their own management sites to avoid existing user complexities. However, senior management at the LWT at the time considered that the opportunity to partner with the TLP reflected a unique financial opportunity for the conservation NGO, for something that only amounted to 'an easy tree planting project'. By the end of the first two years, from LWT's perspective, however, a 'value for money' of the contract had all but evaporated. In staff time alone, the BDO arrangement is calculated to have cost the conservation NGO over three times the fee they received for the offset (NGO1-TLP 260116).

Figure 19 Offset planting scheme



Source: TLP BOMP 2015

The specific ecological management to be performed at Streatham Common to make up the compensation of the biodiversity offset was a mixture of woodland planting and habitat enhancements through management. The London Wildlife Trust identified seven parcels for potential management and planting (shown in Figure 19), which the TLP consultant ecologist verified and approved using the DEFRA metric to calculate the number of units that each would deliver (CE-TLP 201113). Of these seven habitat parcels within the common, parcels 1-3 were located along the boundary areas of the common with recorded habitat baselines of amenity grassland dominated by perennial rye-grass, with cock's foot and wall barley, dandelion, white clover and plantain (BDO BOMP 2015). Parcels 1 and 2 were populated by some mature London plane trees and felled specimens had been chopped and left as deadwood habitat. As part of the BDO planting scheme, all three parcels were to be converted 'into woodier shrubby areas' (CE-TLP 201113) and during the planting work in February 2014 parcels 1 and 2 received new standards of hornbeam, pedunculate oak, alder and white willow and whip mixtures of hazel, hawthorn, guelder Rose, field maple, dog rose and goat willow to complement the existing tree lines (BDO BOMP 2015). The fourth parcel was a small orchard area that

was included as part of the 'horse trading' agreement (NGO-TLP 260116) between the Friends of Streatham Common and LWT and 'wasn't strictly part of the offset' (CE-TLP 201113). Parcel 4 had been requested by the FSC and Lambeth City Council and brought into the scheme as part of the 'engagement/ partnership model basis' that TLP were driving. While LR-TLP01 was not clear whether the enhancement work on the orchard would contribute units within the final BDO budget calculation, the BOMP shows however, that in end it did. The plan was to enhance the diversity of fruit tree species to include apple, pear, cherry and plum including both native wild species and other varieties as well as performing some management on existing trees through selective clearance and replacement planting.

The BDO Management Plan parcels 5, 6 and 7 constitute the largest overall spatial area of the biodiversity offset at Streatham Common at 5.2 ha in aggregate size. These were extant woodland blocks with recorded baseline habitats made up of secondary pedunculate oak woodland also included ash, sycamore, beech, horse chestnut, hawthorn, English elm and hornbeam. The BDO BOMP recorded the under-canopy shrub and ground flora as minimal and the overall structure of the woodland was reported to be poor with low species diversity. Some management with selective thinning of the canopy as well as cut and control of the encroaching bramble on these parcels of woodland areas was recommended. In addition, the planting specification outlined plans to install a new mixture of hazel, hawthorn, guilder-rose, field maple and hornbeam, wild cherry, rowan and goat willow whips (40-60 cm) and more mature 2-3 year old trees (60-100cm) of silver birch, hornbeam, rowan and field maple (BDO BOMP 2015). This woodland management work counted towards the BDO biodiversity unit calculation.

Notably, the work itself and the spatial boundaries of these planting parcels was simply taken from the prior works list and management spatial compartments recognised in the Local Authority's Local Nature Reserve Management Plan. The FSC supplied this to LWT in reference to the woodland management jobs that had been identified but hitherto overlooked in line with funding squeezes (LR-TLP01 July 2016). As such, the management activities were already in line with the objectives of the LNR Management Plan that had been set out between Friends of Streatham Common and Lambeth Council but had been stalling due to lack of funds (LR-TLP 270716). This indicates that BDO funding has come to replace funding for works already identified.

An increasingly apparent feature of the TLP BDO was the growing gap between public performance and the underlying reality. This disjuncture was encapsulated by TLP's

public launch of DEFRA's biodiversity offset demonstration project attended by Owen Paterson, who was Secretary of State for DEFRA at the time. Shown in Figure 17, the picture was a staged spectacle in a little area of grassland adjacent to the car park, thus allowing a quick turnaround for the Minister to 'break some ground' next to a London Wildlife Trust banner. The trees were not actually part the offset and no longer exist, but simply planted in a convenient location for the photograph and 'launch'. The 'minister simply wielded a spade, gave a speech and the trees were left to fend for themselves' (LR-TLP 270716).

In respect to the wider planting schemes, the early challenge for the whips was to survive for long enough to gain visibility and prevent them from being trampled or mowed. While the BOMP recorded that the whips 'would have' tube protection to help provide visibility for rather than to protect against deer or rabbits, upon visiting the site in summer of 2016, it was apparent that only a proportion of these had been given or had retained their shelter tubing. In line with the sporadic provision of protective tubing, LR-TLP01 was generally sceptical about the extent to which the newly planted standards had been given the best chance of survival. In discussing the patchwork of standards that had received mulched areas at their bases he reported, 'they didn't do very much of that surprisingly, they did come back and do some of that but I don't think they did all the trees, some have just been left to fend for themselves as far as I can tell.' (LR-TLP01 270717)

While we were talking about the parcels of woodland planting and management, LR-TLP01 was surprised to hear from me that the Streatham planting scheme consisted of seven parcels in total. He was aware of five areas of planting, which he described as 'three large ones and two smaller ones'. His view was that the three larger areas 'seem to be okay, and in reasonable shape (Figures 20 and 21), but the other two; one has completely disappeared and the other one has barely survived' (LR-TLP01 Jul 2016). In referencing the LWT BDO map and through walking around the common with LR-TLP01, it is easy to see that the area that has disappeared is parcel 3 (Figure 22). Planted at the south-western corner of the common, this zone of the park acts as vehicle access and location for an annual summer music festival. As such, the lorries driving over the area to set up for the event had obliterated the trees. LR-TLP01 was further concerned about the lack of shelter tubing for the rest of the whips, while noting that when they were no longer visible through the long grass, the offset planting has just been continually mowed over by Lambeth gardeners. In respect to parcel 3, LR-TLP01 remarked:

> It was a planned area, but even before they were destroyed by lorries they were not surviving well. It is a very wet part of the common. London Wildlife Trust always sold this to us as something to see whether it was possible to find city areas where you could successfully carry out this kind of project, but how they measure the success of it, I don't know. (LR-TLP 270716)

An expectation that not all of the whips would survive had been noted in the biodiversity offset management plan. The BOMP Maintenance Regime further proposes that

> A proportion of whips will probably die over the course of the first three years. Standards that die or are irrecoverably damaged in year 1 or 2 will be replaced in the following winters. The number of dead or damaged whips to be replaced will be determined after an annual review over three years (for example, location may prove to be problematical and therefore new locations sought).

Figure 20 Young whip planting as the biodiversity offset

Source: Author's photographs

Figure 21 Young offset planting scheme intact

Figure 22 Offset parcel 3 ‘obliterated’

Source: Author’s photographs

The site monitoring responsibility falls principally within the remit of the LWT but with 'assistance' from TLP and Lambeth Council until 2018 after which time Lambeth Council will take over the monitoring and management of the offset. Although, given the existing arrangement of stakeholders and the lack of funding at Lambeth Council to engage with the LNR up until 2016, the attention that the council would be able to give for monitoring the biodiversity offset going forward is questionable. LR-TLP01 was interested to know whether Lambeth Council would receive funds for the purposes of on-going management and also whether these would necessarily be allocated to BDO to prevent them 'being sneaked into a general pool and used for cutting the grass or something'. He mentions 'that's an interesting question - will the funds be ring fenced and only be spent on the project?' (LR01-TLP 270716).

Achieving the biodiversity budget

The seven parcels of habitat within the Streatham Common offset planting scheme were calculated to provide a total of 38.13 units in compensation. In combination with the other two offset sites at Brockwell Park and Ten Acre Wood, the total biodiversity units were calculated to provide 73.12 units as the total biodiversity offset. Through my data collection, I was not able to identify why this proposed net gain of 31.12 units (from an impact of 42) was deemed to be an appropriate yield or net positive gain for the TLP. The unit calculations and the decisions taken over them were not available for public consumption.

What is worth noting generally is that the total offset unit value of 73.12 was an aggregation from eleven individual habitat parcels from three separate offset sites across London. The units were pooled together as the compensation for biodiversity loss across nine impact sites on the TLP route across a large tract of southern England. Unit value aggregations such as the one showed in Table 11 obscure the numerous individual value judgements taken at each of the eleven individual habitat parcels. As we have seen throughout these and the previous case studies, the value judgements involved with filling out the DEFRA metric included reaching stable conclusions for the input scores for: 1) habitat distinctiveness; 2) habitat condition; 3) difficulty of habitat restoration; 4) biodiversity offset spatial strategy and 5) time to target condition. These classifications can sometimes be hard to pin point, especially if they relate to mosaic habitats without clear boundaries for assigning to any single distinctiveness or as CE-TLP articulated, are based on condition assessment guidance that is not suitable for non-farm ecosystems and landscapes.

To arrive at this total unit 'budget' that is deemed to provide the net gain, CE-TLP made 55 individual value judgements, made up of five classification assessments on eleven different habitat parcels (Table 12). Each value judgement using the metric entailed categorising a bounded and individuated habitat parcel into three value buckets as 'good', 'moderate' or 'poor', 'high', 'medium' and 'low'. 'Time to target condition' multiplier scores are allotted to increments of five year periods and assigned numerical surrogates that flow from these classifications. The composite valuations are deemed to have followed DEFRA's standardised guidelines, though as we have already seen, professional judgements are also necessary to fill gaps left in the guidance or other local anomalies. Much like the journey that the metric calculations followed through the South Devon planning application, the assumptions around these valuations have been obscured from view and subsequently compounded as black boxes. By presenting a series of numbers proposed to be the biodiversity unit budget of loss and gain enables TLP to claim that they have achieved a 'net gain' of biodiversity today, 30 years[34] before such a claim could be truthfully verified.

[34] 30 years is the longest 'time to condition' risk multiplier used in the calculations.

Table 12 Biodiversity units by habitat parcel across the whole offset project

Habitat area	Size (ha)	Time to target condition	Biodiversity Units
Streatham Common			
Parcel 1	0.2	10 years	2.3
Parcel 2	0.25	10 years	2.9
Parcel 3	0.06	10 years	0.3
Parcel 4	0.29	15 years	0.34
Parcel 5	5.2	15 years	7.62
Parcel 6		20 years	24.72
Parcel 7		20 years	
Total			38.13
Brockwell Park			
Parcel 1	0.73	30 years	2.61
Parcel 2	0.45	5 years	2.25
Parcel 3	0.29	30 years	1.04
Total			5.89
Ten Acre Wood			
Whole area	5.6	5 years	28
Total			28
Total of all three			73.12

Source: TLP BOMP

This chapter has shown how the presence of displaced, masked, sometimes arbitrary value judgements, albeit made with professional adjudication always sit in balance with other value systems. The wider political requirements of these calculations demand that they made 'economic sense' to meet developer's 'the business case' or enable accelerated project planning. The ways in which these political imperatives of the practical 'valuation' of biodiversity have shaped the numerical outcomes are abstracted and concealed from view within the calculative processes described here. These factors point towards an instability in the numerical circulations of biodiversity 'gain'.

There is further instability within the broader actor-network that reproduces and amplifies the narratives of success in achieving 'net gain', located in the precarious arrangement of human actors and the tenuous commitments and obligations set out for each party within the BOMP and the legal agreement that accompanies this. These commitments are legitimated and formalised within a legal contract, which is also performative in its capacity to represent distributed roles and responsibilities as diligently observed fait accompli long before they have actually been realised. There is little in the way of long-term means of enforcement or follow up beyond a five year period and certainly little scope for recourse should the evaluations reveal that the offsets had vanished. As these instabilities fade from view and become neutralised via official and approved textual records, public discourse and associated performances, these inscription devices actively fix and stabilise the logic and coherence of corporate biodiversity offsetting and TLP's 'net gain' for nature. The capriciousness of this project and its ancillary effects is stabilised by official reports and agreements. In so doing, it ossifies into accepted, and unquestionable accounts of success and 'no net loss', thus allowing TLP to make claims to this effect decades before they could earnestly argue as such. The chasm between public facing corporate accounts of a 'net gain' for biodiversity and the direct experiences of the planting schemes of local users is abundantly apparent. The idea of 'net gain', in material rather than abstract terms is challenging, as the BDO representative of Friends of Streatham Common expressed:

> I mean the whole principle of net gain - I have never really understood. You have this matrix, which is some bogus way to calculate the values in land and planning. Plant a few trees on existing land and that's a net gain? But the real costs of something like this to Thameslink should have been peanuts! Whips cost a £1 each. There we are- £700, done. It was all done by volunteers and

> some management time, and all the intermediaries, you know that's where all the money goes on the consultants, and the PR firms and everything else. It's not on the actual work. (LR-TLP01 270716)

7.4 Discussion

This chapter has contributed empirical evidence of one of England's first voluntary BDO contracts. The most significant contrast between this case study and the prior two is that the empirical focus charted the implementation of the offset, rather than the calculation of impact scores at the development sites. An offset partner was identified and enlisted who in turn solicited three actual offset sites for conservation investment across London. Physical planting started promptly thereafter. Although the elements of the assemblage resemble the LPA contexts, their configurations were distinct from the prior two case studies in fundamental ways. Although, in similarity to the LPA case, what has emerged as a central theme from the empirical data, is that context hugely shapes how actors assemble the values of biodiversity in situ. The voluntary and private nature of this BDO arrangement is therefore pertinent to how BDO operates within such contexts in practice. Below, I outline a variety of differences between the practices of valuing biodiversity and enacting BDO in a voluntary, rather than a compliance context. Drawing on the analytic of assemblage, I highlight various significant implications arising from a growing uptake of NNL in corporate sustainability agendas in England and elsewhere.

1. *Nature of the offset provider and contestation around losing or gaining access to 'biodiversity'*

Firstly, although there are significant divergences between the two contexts, this chapter has shown that the actors in the voluntary private corporate social responsibility (CSR) contexts of BDO in England encountered various practical issues that echo the experiences of those within local authority compliance contexts. Many of these pragmatic issues necessitated processes of negotiation and compromise so as to 'keep things going', and ultimately realise the completion of the contract in spite of various frictions. Key amongst these challenges for TLP were the identification of appropriate offset providers (specific to their needs for a public and visible project) and the social embeddedness and legal status of the land proposed to provide biodiversity units. In the same ways that LPAs and conservation NGOs working with offsetting in the planning system in Devon preferred to undertake ecological compensation investments on land under their own control, this factor was also an important issue

for the TLP case study. This chapter illustrated why the ownership and governance arrangements of land subject to conservation investments is such an important component for BDO through illustrating the frictions associated with contested uses of and claims to land in London.

Local user resistance to the delivery of additional woodland in a heavily used, but primarily openly landscaped London park complicated matters. These on-going negotiations compromised the market efficiencies of BDO as a trading mechanism. Such forms of contestation and local frictions (Tsing 2000) push up 'transaction costs' for BDO. Network Rail's priorities for hasty arrangements that made 'good economic sense' and represented 'value for money', clashed with practical issues in delivery. The imperative was to have a fast, public, visible habitat recreation project, offering a good economic value per unit of biodiversity framed according to the corporate strategy of Network Rail. Ironically, these objectives translated into very poor value for money for other actors in the process. Notably, the conservation NGO ended up significantly subsidising the process with their existing funds.

The difficulty over identifying offset providers that have the correct combination of factors to meet various developer requirements is one of various contradictions between the theory and practice of BDO. The assumptions on which DEFRA and other advocates of BDO tend to base expectations for a simple trade of loss for gain, overlook the complexities of soliciting appropriate land as offsets. Identifying and securing land for the provision of compensation biodiversity is not a smooth process, and instead belies the neoliberal orthodoxies anticipating the efficiency of trading (Sulzman and Ruhl 2000). Relatedly, critical theoretical expectations of BDO anticipate that the mechanism is defined by social equity implications for the de-politicisation of biodiversity destruction through development and the eclipsing of local valuation of habitats and nature (Taherzadeh and Howley 2017, Apostolopoulou and Adams, in press). Conversely, this case study has illustrated how social contestation arose in relation to habitat *enlargement* at the offset site rather than reduction or displacement at the impact sites. Perhaps counter-intuitively, in some cases the re-planting of woodland in areas valued for their openness is the source of controversy[35]. Nonetheless,

[35] This is a problem the Forestry Commission in the UK face with respect to the prospect for planting woodland in primarily grazed landscapes with wide-open expanses, treasured by British walkers.

what this chapter does highlight is that political processes inevitably find their way back in where new claims over land and its uses are concerned. Whether this contestation is related to the development site or the land identified for the provision of units, this issue will likely remain a pervasive characteristic of offsetting arrangements in England and elsewhere.

2. Reconfigurations to the conservation 'order'; institutional and discursive shifts

The voluntary nature of the BDO contract highlights a novel arrangement of actors, institutional roles and the reconfigurations of relationships characteristic of 'private sector engagement' in conservation (MacDonald 2010b). It also illustrated the discursive strategies that were mobilised in service to this agenda. I will firstly explore some of the significant implications for shifts to the institutional arrangements that BDO spells for conservation in England, before exploring the discursive strategies that were integral to these shifts.

As with the other case studies, the work of one or two catalytic individuals were central to enacting BDO in practice, in spite of, rather than because of higher organisational commitments. The chapter demonstrated that it was due to these two individual protagonists actively positioning and framing BDO correctly, that the approach found legitimacy in TLP and subsequent scale through Network Rail and Balfour Beatty, respectively. These actors performed work that demanded a broad range of particular skills related to managing different audiences with different interests (for example senior business executives as well as civil society). Such competencies included framing the business case for undertaking BDO in infrastructural contexts, in balance with the moral imperative for doing so (I expand on the interplay of these two discursive strategies below). The professional collaboration enlisted supplementary expertise, expert capacity and outreach to broader networks and forums in practices of advocacy, public relations, technical knowledge and authority. What can perhaps also be said is that this partnership and the scaling of BDO in both organisations has opened up a sizable business opportunity for Balfour Beatty, most probably, for many years to come as the principle of 'net gain' was brought into the heart of Network Rail to be rolled out across its full range of infrastructure projects.

Intermediaries and consultants are crucial to the advancement of, and negotiating, the 'green deal' (Fairhead et al. 2012). Chapter 5 explored the importance of the Environment Bank and other sub-contracted brokers as key 'translators' and enablers within the assemblage. The roles and interests of consultants, advisors and other intermediary actors is paramount in this case study, and most likely, many other corporate sustainability contexts, especially those like BDO which entail technical complexity, both in the Global North and South. Such actors are positioned to capture the bulk of the transactional value and therefore benefit from the growth of such trades in environmental governance. The role of these actors should not therefore be underestimated in respect to shaping and formatting the legitimation processes of 'valuing nature' within the green economy.

3. New roles for NGOs

The novel institutional configurations of BDO also indicate the changing nature of the roles that conservation NGOs play in conservation going forward (some of whom of course, may also perform the role of intermediary, as was the case in the TLP example). As with the RSPB in South Devon, this case study illustrates how conservation NGOs in England are being drawn into the BDO arrangements in somewhat ambivalent or reluctant ways. The overriding narrative for NGO involvement in each of the case study locales was the need to be 'at the table', so as to understand better and to influence the process and outcomes. The positions of NGOs however, are not uniform. Rather, they comprise contrasting and contradictory objectives and viewpoints. Some individuals within the same organisation may be more enterprising, especially at a senior management level, with interests for 'releasing money into the organisation'. Others are simply 'pragmatic', and are 'making the best of a bad situation' of existing planning arrangements. As we have seen throughout all the case studies, NGOs are primarily favoured conservation partners, since they provide legitimacy to the innovative, and at times, controversial processes of market based programmes. Maintaining legitimacy is especially important to corporate sustainability programmes where reputation management and public relations are part and parcel of the initiative (I expand on the idea of public performance below). For this reason, TLP turned away from new conservation actors within BDO like the Environment Bank in favour of a partnership with the London Wildlife Trust.

Paradoxically, it is these new institutional arrangements and the reconfiguration of traditional roles which simultaneously also threaten to undermine the legitimacy of NGOs going forward. Under BDO, NGOs now find themselves in direct contractual and

financial relationships with developers, while 'selling their services' (McDonald 2010), even while this activity is avowedly an effort to ameliorate the harder market edge of BDO and its worst excesses from purely profit driven actors. This institutional shift is consistent with the rubric of neoliberal conservation generally, which is shaping a 'renegotiated order' to the field, characterised by new institutional alliances and private sector 'engagement' (ibid.). There are questions over how BDO might alter NGO driven conservation into the future. Such questions include the degree to which England's conservation NGO's may become limited by what exactly can be said in contestation to development led biodiversity loss, how and whether they choose to participate in such practices, whilst potentially weakening their abilities to do so.

4. Questions over additionality

Ensuring that biodiversity offsets deliver 'additional gain' is a central tenet in DEFRA's pilot policy. DEFRA's 2013 Green Paper outlines various complexities of ascertaining whether an offset is truly additional, or simply part of conservation investment that would have happened anyway. The report also discusses scenarios where it may be difficult to verify additionality. The first scenario relates to a habitat banking model, the second to maintaining a site in good condition at the end of a funding or grant period, and the third relates to incidental biodiversity benefits that would arise from other planning requirements. The issue of additionality in respect to BDO gradually taking over allocated conservation programmes that are (for reasons largely associated with other neoliberal political norms), not receiving adequate funding, is overlooked by DEFRA. And yet, this example shows that that is exactly what is happening. Anecdotally, this case study example shows that the BDO conservation work tied to the financial compensation was acting to replace previously identified conservation management activities associated with the Local Nature Reserve at the offset site. Can the meeting of absent, but pre-identified funding requirements, really be said to have counted as 'additional'? The ambiguity between utilising BDO as an innovative funding mechanism (Comerford et al. 2010) for pre-identified works lacking actual funding, and establishing the model as an entirely additional conservation programme to existing arrangements, indicates uncertainty over whether BDO would gradually displace existing conservation funding in England in general. One potential risk points towards the abandonment of existing streams of conservation funding, in favour of a laissez faire attitude that BDO could happily make up any shortfalls. Furthermore, as an exacerbation to the risk, under BDO the fulfilment of previously identified conservation requirements becomes contingent on development impacts on

biodiversity elsewhere, exemplifying the re-configuration of conservation as development led (Pawliczek and Sullivan 2011) as discussed throughout this thesis.

5. Self-regulation and the quality of intentions

Amongst the most significant of the institutional characteristics for the development of voluntary BDO, as opposed to compliance and regulatory practices contingent on obtaining planning permission, is precisely the absence of any regulatory oversight. I have noted that, compared with the LPA BDO contracts, there was little to no negotiation over the calculations of the impact or offset values at TLP. The absence of haggling over biodiversity value calculations at TLP, as we saw in Warwickshire and Devon, is due to the fact that the firm *controlled* the calculative processes themselves and, furthermore, did so in private with little or no transparency. The development of voluntary, unregulated initiatives for using calculative procedures such as NNL and BDO, going above and beyond 'business as usual', compromises the accountability of such processes, and in so doing, de-politicises and neutralises such decisions (Sulzman and Ruhl 2000). It is under these conditions, that fears over BDO becoming adopted as a strategy for 'green washing' controversial developments, would seem rational. In circumstances of self-regulation, not only do the political contexts and wider structuring values of biodiversity valuation matter, so too do the actors' intentions (Kallis et al. 2013). Stakeholders involved in the TLP offset primarily sought better biodiversity outcomes. Though while NNL and BDO mainstream as corporate sustainability orthodoxies, there are heightened risks that in such contexts where environmental governance is weaker, the biodiversity impacts are greater, competitive stakes are higher, or actors' intentions are just simply less benevolent, BDO can rapidly become the much maligned and feared 'license to trash'.

6. Discursive strategies and plural value systems

This chapter has shown that within a corporate voluntary context of BDO, various discursive strategies were central to the enactment and validation of the mechanism. These strategies drew on duel justificatory narratives, casting BDO simultaneously as a rational business strategy, as well as a moral thing to do. Both narratives served as legitimation strategies so as to build internal and external consensus around the cogency of the policy. Legitimation helped the actors spearheading the DEFRA demonstration project to naturalise BDO and NNL as logical and urgent courses of action, while concurrently deflecting or managing potential antagonism (Nyberg and White 2013). And yet, as this case, and as the other cases have also shown, discourses

and the values that they evoke actively shape practical action and the pragmatics of BDO arrangements. Pursuing voluntary BDO according to its 'business case' affected the ways in which the contract played out in practice, such as the speed of the process, the location of the receptor site and type of biodiversity investments that were considered appropriate to suit these priorities.

Nonetheless, a simple justification of business self-interest does not account for the individual agency and sense of moral justification that actors mobilised in respect to the sincere interest in 'putting something back' or an authentic 'green' normativity**.** In so far as BDO is considered to be reconciling competing orders of worth (Boltanski and Thévenot 2006), it acts as a market-green compromise (Nyberg and White 2013). In situ actors perceive NNL and BDO as capable of delivering multiple social goods (Boltanski and Thévenot 2006) that are held together through such compromises. I expand on this in the next chapter.

The translation of biodiversity into numerical unit values features as an intrinsic component to the business rationale necessary to legitimate BDO at Network Rail. Numbers were celebrated for offering such utility. In this way, NNL and the quantification it is constituted by, is amenable to business vocabularies of cost-benefit analysis due to its commensurating properties and the reduction of biotic and social heterogeneity to a common interchangeable unit. These frames are also explicitly favoured for being appealing to business audiences on account of their black and white simplification of complexity and enabling of quick calculative assessments. Such is the avowed intent of powerful advocates working to stabilise market valuation and pricing approaches in conservation. Peter Bakker, head of the WBCSD, for example stated recently at the BBOP Summit in 2014 that:

> We need to improve our language. I am a businessman and 'biodiversity loss' means nothing to me. We need to frame it in the context of there being no more bees. A language that business is happy with is natural capital… If people create goals business can relate to, then we can stand back and let business be the engine of change. (Bakker speaking at the BBOP NNL Summit June 2014)

And yet, as highlighted in this and other examples throughout this thesis, NNL is being frequently mobilised as both a business rationality *and* moral imperative by actors making sense of the new approach. The calculative device is taken to be synonymous with environmental care and empathetic or dutiful (deontic) value systems, rather than solely for business expediency. Through conveying the moral weight of 'saving

biodiversity', NNL is a 'boundary object' (Star and Griesmer 1989) perceived to reconcile various value systems and deliver compromises to different parties. It is precisely NNL's ability to capture and invoke value plurality that makes it such a potent conceptual and practical technology for conservation norms going into the future.

7. Between performance and reality

Following the 'success' of the initial TLP offset, Network Rail has embraced *Biodiversity Net Positive* as a new corporate sustainability standard across the whole firm. Balfour Beatty meanwhile has been contracted in the delivery of this policy for the future of Network Rail's future development initiatives, which includes the maintenance and expansion of 20,000 miles of rail track across the UK. Echoing the discussion from chapter 4 in respect to the ways in which conceptual technologies like NNL travel through space and time, this case study has highlighted how NNL 'sticks' to different contexts and is elevated as a new organisational or institutional standard. The example has also highlighted how such examples and narratives of success help translate and carry NNL into new contexts, amid frequently ad hoc and chance circumstances. For example, the TLP's offset was as much an example of two individuals 'having a go', in light of the availability of calculative device in the DEFRA metric, as any overt ideological commitment to the market potential for transforming biodiversity conservation (c.f. Bayon and Jenkins 2010).

All the same, there was a certain amount of spectacle involved with TLP in relation to maintaining a strong and positive public image. The spectacle was partly related to being the DEFRA demonstration project, but also partly a necessary component of the 'business case' and appearance of corporate sustainability. Within this context, failures, shortcomings and uncertainties faded from view within the official narratives of success. It is too early to observe the habitat outcomes of the offset arrangements, since these will take years to materialise. The chapter illustrated that accounts of a successful net positive benefit for biodiversity are in fact a precarious aggregation of value judgements and compromises smoothed into official documents and packaged up as fact. This performance itself has a value for being official and authoritative while eradicating doubt and instability as well as inviting buy in.

The chapter highlighted some of the constitutive socio-political processes in which the performance of programmatic 'success' and NNL is achieved. It has also reiterated the disjuncture between these public accounts of success and the complex local realities to which they relate. I identified how TLP's accounts of success were stabilised and

performed discursively through the circulation of textual records, organisationally through professional alliances and networks, institutionally through accepted narratives and political dynamics, and technologically with novel representational devices and pictures that create compelling yet abstract depictions of biodiversity loss and 'net gain'. For example, 'statistical picturing' devices (Demeritt 2001) portrayed the scores of biodiversity impacts at each of the development sites along the TLP route (in Figure 18) and equivalent numbers as overall net gains. It is precisely these kinds of devices that permit the control at a distance from 'local centres of calculation' (Latour 1987). Similarly, as Jim Igoe (2010: 389) discusses in relation to the circulation of referents generally, 'spectacular productions thus become their own evidence, continuously referring back to themselves in affirmation of the realness of the world(s) that they show their viewers'.

The empirical evidence of England's early corporate biodiversity offsets is consistent with geographical observations of the field of 'business and biodiversity' more generally. Accounts of 'success' and the exercises in agenda building are explicitly performative - they are entrained on bringing people together in networks for 'public enactments' to extend and strengthen the assemblages on 'dramaturgical stages' (Wilshusen and MacDonald 2015). The power of these success stories is significant for the wider assemblages and growing legitimacy of BDO in England and further afield. A sense of coherence at a global policy scale is central to the sense of legitimacy and purpose at the successively lower scales. Indeed it is exactly such accounts of success that will likely be mobilised by actors elsewhere in justification for adopting BDO. DEFRA relied on equivalent 'success stories' to articulate and validate its intentions for undertaking a pilot study in England in the first place, such as Australia's Bushbroker model (DEFRA 2013). A decade down the road, the empirical evidence emerging of Australian offsetting, indicates that its biodiversity outcomes range from weak to disastrous (NCC NSW 2016). Network Rail therefore, becomes one of various other case studies that circulate and work in service to the construction of biodiversity valuation policies. Front-loading claims of success in NNL or NG and the subsequent circulation of such accounts, mistakes the 'paper offsets' (Quétier et al. 2014) for actual biodiversity gains. It is precisely this inertia, between the initiation and uptake of the policy approach and future material-outcomes that makes biodiversity offsetting, at its most basic level, little more than a gamble. The extent to which this risk is obscured by the moral legitimation that NNL is the 'right' thing to do, closes down alternative pathways

and meaningful debate about the impacts of the social and natural contract between infrastructure developers and civic society more generally.

The focus of the thesis remains with the themes of moral justification, conflict and compromise in turning to the next chapter. In the following and final empirical chapter, the focus moves to the BBOP, DEFRA and ZSL biodiversity offsetting summit in London in June 2014 after the pilot had ended. The aim of the following chapter, in drawing on the pragmatic sociology of critique is to explore more fully how actors advance claims and critiques of BDO, so as to make sense of its conflicts, compromises and tensions. The focus now zooms out from the localised case studies of the English pilot study towards a higher geographical scale of broader BDO assemblages.

PART 4

CHAPTER 8
ARTICULATING THE MANY GREEN ORDERS OF WORTH AT THE FIRST GLOBAL SUMMIT ON BIODIVERSITY OFFSETTING; *TO NO NET LOSS OF BIODIVERSITY AND BEYOND*

8.1 Introduction

Over the course of the DEFRA pilot study between 2012-2014, BDO in England was situated within an on-going dispute and controversy, attracting outspoken advocates and critics in equal measure (Sullivan and Hannis 2015). Supporters and detractors for BDO made fervent contributions to public discourse surrounding the possible effectiveness and indeed desirability of the planning system embracing a BDO mechanism[36]. In the prior chapter, I explored critique circulating in the media, illustrating the tensions this opened up for the Thameslink Programme. In addition, this dispute was animated through the multitude of responses and contributions submitted to both the DEFRA Green Paper Inquiry and the UK Parliament's Environmental Audit Committee's (EAC) Inquiry, held in 2013. Through empirical discourse analysis of the written evidence to the EAC Inquiry, Sullivan and Hannis (2015) illustrated how opposing stakeholder positions broadly frame the policy in one of two ways. The first group sees BDO as 'revolutionary and innovative means of pragmatically providing multiple-win solutions to both environmental and economic issues' (ibid.: 10). The other perspective questions the broader practical and contextual realities of the policy approach (i.e. critique on its own terms). This second position also levelled a more radical critique by challenging:

[36] Although, at this stage, I would point out that arguably treating the mechanism of BDO as the source of controversy was misplaced, since the prior and far less controversial introduction of a NNL policy standard to the NPPF in 2011 had already accomplished much of what BDO critics feared offsetting would do. In so far as NNL locks in a balance sheet accounting approach to conservation through orienting around an aggregate rule, it circumscribes certain calculative means of meeting this goal such as the DEFRA metric, as discussed throughout chapter 4. BDO as an official policy approach is not pre-requisite for LPA's to embrace offsetting, NNL is enough.

> the appropriateness both of monetary valuation and of markets, arguing these cannot adequately reflect intrinsic values conferred by uniqueness or the consequent non-substitutability of species populations and habitats located in places *(*ibid.: 10*)*.

To summarise a rich empirical engagement with this EAC Inquiry, Sullivan and Hannis (2015) arrive at the conclusion that the impasse over BDO emerges from opposing ways of 'understanding both the value of nature, and the nature of value' (*ibid:* 10).

Similarly the 2017 paper by Apostolopoulou and Adams, in *Oryx* evokes some of the problematic ontological and ethical dimensions of BDO through challenging its dominant framings of what biodiversity *is* and how, therefore, conservation policy and practice should respond. A related discussion over the connection between ontology-epistemology-ethics is elaborated in Sullivan 2017, and briefly discussed in chapter 2. In particular, Apostolopoulou and Adams (2017) focused on four ways BDO actively reconfigures the ontologies and ethics of biodiversity and conservation. To paraphrase their conclusions, they argue that offsetting, erroneously and dangerously reframes biodiversity as measurable isolated units lacking locational specificity rendering them amenable to pricing. Under offsetting, conservation, they propose, becomes merely a means of exchanging monetary values and a practice driven through land development and economic growth (ibid:. 1)

These two papers form the basis of the approach of this chapter, which explores the multiple value systems, conflicts and compromises animating the dispute over BDO. The chapter builds on the findings from these recent contributions and combines them with the theoretical frames of the pragmatic sociology of critique to empirically explore the architecture of argumentation that sustains BDO as a controversy. Throughout the preceding chapters I have illustrated the ways in which BDO creates new values that people struggle over in practice. I have also highlighted the ways in which, under a system of BDO, actors and devices seek and enact a series of pragmatic compromises across dissonant value systems with material consequences for conservation policy practice and outcomes. In line with the overall chronology of the pilot period, which is largely reflected in the structure of this thesis, this penultimate chapter returns to the moment that opens the first chapter, namely the DEFRA, BBOP, Forest Trends, ZSL BDO summit in June 2014 at London Zoo: *To No Net Loss and Beyond* (denoted as the NNL Summit going forward).

In this chapter, I document the justification frames within the debates for and against BDO through event ethnographies conducted at these conferences in 2014. I conducted detailed discourse analysis on the public debate staged at the NNL Summit and drew from wider ethnographic observations from the counter forum held by campaigner and NGO groups at the same time in Regents Park the day before. I was involved as a volunteer coordinator at both events and as one of the organisers for the second. As I discussed in chapter 3, the dramaturgical public enactments (Wilshusen and McDonald 2015) of policy events and summits make fruitful sites for empirical research into the globalisation of ideas and building of epistemic communities (Brosius and Campbell 2010). The NNL Summit furthermore, was an important moment in the policy cycle and political interest in BDO, not just in England, but the wider global BDO and conservation community, evidenced through the international nature of the event made up of 270 delegates and speakers. The moment also represented the fulcrum of BDO in England after which, things started to quieten down as DEFRA conspicuously delayed and eventually put off indefinitely any official announcement about the Government's intentions towards BDO following the pilot study.

Before the NNL Summit, there had been few examples of real-time dialogue between rival and divergent views over BDO. This deficiency was rectified by BBOP when it convened a public debate to open the conference. In recognition of the stubborn impasse that had emerged around BDO, the debate's title and motion was tabled as *Agree to disagree? Including biodiversity offsets in the mitigation hierarchy: opportunity or peril?* Six speakers from the private, NGO and academic sectors were involved, with three positioned on either side of the motion. Those arguing for BDO as an 'opportunity' were Tom Tew, CEO for the Environment Bank Ltd and ecologist turned business director, Susie Brownlie, ecologist and founder of South Africa based BDO consultancy, Brownlie Associates and Morgan Robertson, Associate Professor of Geography at University of Wisconson-Madison and former research fellow at the EPA, who arguably has written more that could be characterised as critical of market based ecological compensation schemes than in favour. Representing the team levelling the critique of BDO (its 'peril') were Hannah Mowat, campaigner and policy advocate for civil society environmental organisation FERN Europe, Aerial Brunner, Head of EU

Policy for Birdlife International[37] and Isaac Rojas Friends of the Earth Costa Rica. Going forward these two groups are denoted as 'advocates' and 'critics' respectively.

This chapter proceeds by introducing the pragmatic sociology of critique (PSOC) (Boltanski and Thévenot 1999, 2006). It firstly outlines this theoretical frame in more depth and considers recent contributions specifically related to political ecology. The chapter then outlines the methods deployed for this analysis, combining the theoretical frames of PSOC with the findings put forward by the Apostoloupoulou and Adams (2017) and Sullivan and Hannis (2015) papers to arrive at a set of codes for analysing the debate at the main Summit and to inform my observations of the counter forum. I then present the findings from the detailed qualitative analysis and conclude with a discussion of key findings. The chapter argues that divergent ontological foundations of what biodiversity *is* form the basis of the dispute due to ethical frameworks of action they imply (Sullivan 2017). In addition, the ways in which these different ontological frames appear as compromises with other value systems, or 'orders of worth' (Boltanski and Thévenot 2006), create a moral complexity that sustains the dispute as an impasse. In summary, this chapter contributes theoretically and empirically grounded insights to clarify and elucidate the value conflicts embedded within efforts to value nature through BDO.

8.2 Pragmatic sociology of critique

In their 2006 work *On Justification*, Boltanski and Thévenot sought to map how actors construct claims and critiques through social norms, implicitly value-laden concepts and moral assertions. *On Justification* groups moral assertions (underpinning criticism and justifications) into six overall 'orders of worth' across the market, industrial, civic, domestic, fame and inspiration value worlds (Table 13 below). These spheres of value are derived from classical treaties of political philosophy and represent 'conventional forms of worth which sustain most legitimate criticisms and justifications in public' (Thévenot 2011: 36). Boltanski and Thévenot (2006) argue that during controversies, actors tend to structure their arguments by appealing to political-moral accepted forms of 'duly qualified realities' comprised of one of several or overlapping 'orders of value', which form the backdrop to and rationalisation for their claims.

[37] Brunner wryly noted at the beginning of the debate that while he was attending the conference on behalf of his pro offsetting employer (Birdlife Europe) he had been invited to speak to his personal views that were broadly sceptical of BDO.

Within each order of worth, certain rules of acceptability demand equivalence and cogency thereby determining how facts, norms or 'utterances' display commonality (Boltanski and Thévenot 1999). Counter claims are thus only intelligible or coherent when they are compatible with the order of worth in which the original claim was couched. In this sense, critique and justification must, thereby occupy commensurable 'orders of worth'. Boltanski and Thévenot (1999) refer to these frames of equivalence as 'reality tests', which determine the legitimacy of critique or justification. Each situation will have its unique forms of equivalence in which certain claims are considered appropriate and against which, claims from another 'world' or 'order of worth' are not. During conflict, they argue, actors must converge towards the objects relevant and legitimate to those situations. In a road collision for example, legitimate points of reference might be the highway codes or state of tyres etc. (ibid.), whereas illegitimate ones would originate from other orders of worth. The performance of equivalence within bounded orders of worth prevents argumentative incoherence through a 'mixing of worlds' and subsequent illogical justifications (Boltanski and Thévenot 1999).

The notion of value commensurability and equivalence is central for this research enquiry into the way compromises are built in the dispute surrounding BDO, and indeed in the construction of exchange values. The same reasoning also illuminates the universalising capacities of strict or 'flat' (Fourcade 2011) value regimes like price and numerical scoring, which appear as structurally un-equipped to accommodate value plurality on a substantive level. Another example is the standardisation of objects or institutionalisation of objectified rules, such as time and schedules, which provide frameworks of equivalence to maintain coordination in the course of common action.

To supplement the original six orders of value, Lafaye and Thévenot (1993) proposed the addition of a new 'green' order of worth as a nascent sphere of ecological justification. Thévenot et al. (2000) tested the robustness of this modification through comparative empirical studies of environmental controversies in France and the US. In querying the grounds for adopting a separate 'green' order of worth along with the other six, they noted that while a unique green order was 'gaining specificity' in political disputes, it was 'still often used in combination with other types of justification' (Thévenot et al. 2000: 237). The green world, they found, tends to sit in a compromise with others from the original six. In discussing this empirical study, Blok (2013: 5) suggests that Thévenot et al. settle on a conclusion that points towards the moral complexity of environmental disputes, 'as actors employ 'green' justifications, in

compromise with other orders as well as by reference to its own repertoire of evaluation' (emphasis added).

In a later work, *The New Spirit of Capitalism,* Boltanski and Chiapello (2007) developed the idea of compromise and detail the means by which the market order tends to subjugate others, including the green order. It follows that within BDO, the rhetoric of 'pragmatism' thus appears as the 'magic' of a compromise in an erstwhile hegemonic process of subjugating environmental values (green) to business and market tests (Nyberg and Wright 2013). This line of thinking sees the construction of a compromise between market and environmental logics that leads to justifications of 'green' practices only in so far as these will further the interests of the market truth tests (ibid.). As a way of settling disputes across incommensurate orders of worth, compromises appear as unstable resolutions as one order tends to dominate the other (Boltanski and Thévenot 1999).

The orientation to locating how compromises between environmental and other political value systems function is compatible with broader critiques of ecological modernisation (Mol 2002) and the literature around neoliberal conservation (Büscher et al. 2012), although notably not widely drawn upon in these critical works. Indeed, the origins of ecological compensation programmes that are foundationally grounded within the logic of the 'third way' between development and environmental protection clearly encapsulate this settlement between a green order of worth and others. As chapter 4 showed, the *net* in no net loss of biodiversity is the market-green compromise. In relating this settlement back to Li's (2017) notion of 'tensions' within the practices of assemblage, Nyberg and White (2013: 418) propose that the presence of 'compromises thus deny the incommensurability of goods', which instead are made to be compatible through 'forged alignments' (Li 2007a). Latour has recently referred to these as 'crossings' across 'modes of existence' (2013). In a context like BDO that depends on such compromises, the value of actors like the Environment Bank within this assemblage, is shaped by their unique expertise that straddles both planning (development), ecology as well as business backgrounds. Actors that span worlds of market and environment, it seems, are able to disproportionately benefit from the growth of the 'green economy' and prevail while doing so.

Drawing from this model of the sociology of critique, I performed an equivalent reading of the way a green order of worth emerges in the English dispute over BDO. In the table below I have juxtaposed the original seven orders of worth against common 'green' discourses of BDO to identify what the moral-political value compromises within BDO

look like. I use this framework of compromises as the basis of the data analysis that follows.

Table 13 The six and additional green orders of worth and green compromises

Original order of worth	Stand-alone values[38]	BDO green compromise
Market	Economic performance and competition	Business relying on nature's goods and 'services', reducing risks and enhancing profit making opportunities, enabling development. Basis of the 'green economy'
Industrial	Efficiency and rationality based on technical competence and long term planning	Maintaining the aggregate stock of 'natural capital' through scientific expertise using technical capacity for management, measurement and restoration
Civic	Equality and solidarity	Environmental and intergenerational justice
Domestic	Tradition, heritage, local and personal ties	Protection of local natural heritage, access to nature for communities
Fame	Public opinion, renown, reputation	Social license to operate, moral economy of 'green', building of social capital
Inspired	Creativity, emotion and spiritual grace	Utilitarian justifications for health and wellbeing, spiritual inspiration
And Green	Deep ecology, as an end in itself, biocentrism, intrinsic value of nature as a whole and also specific entities[39]	No compromise, a singular or 'pure' biocentric value system

[38] Original definitions drawn from Boltanski and Thévenot (2006).

[39] Latour (1998) draws on a Kantian means-ends definition of morality in considering the idea of a unique, post-humanist 'green' order of worth. To follow Kantian moral philosophy, a uniquely green order of worth would see ecological 'natural' entities treated as ends in and of themselves and never instrumentalised to another's use. Latour suggests that under these circumstances a unique green order of worth would indicate an ethico-political transformation where 'modernisation' gives way to 'ecologisation' - to an untenable form of biocentrism. Latour notes that the intrinsic rights of *specific entities* are well known in environmental ethics. Even so, this uniquely green conviction, he argues, is too specific and singular to fit within the classical treaties on political philosophy from which Boltanski and Thévenot have drawn their original 6 orders of worth, since these works have the human at their starting and

And yet, Blok (2013) contends that Boltanski and Thévenot's and Latour's understandings of 'green' in the pragmatic sociology of critique, amounted only to a partial reading of the moral worths of nature. Instead Blok (2013: 3) argues, 'ecology, in its present socio-political state manifests itself in diverse cognitive and moral grammars, tied to specifiable projects of ecological justification, conflict and compromise'. Hence, Blok proposes that the nature to which the green moral-political order is related is not simply 'nature', but *natures* in a plural value sense. Blok suggests that the opportunities for the pragmatic sociology of critique and its treatment of political ecology are to be found in the way that its main protagonists have each captured different *ontological* foundations for the valuation of ecological entities in public disputes.

In line with Blok's thesis, what initially intrigued me to investigate the dispute as an important element within the assemblages of BDO, is that there is one at all. The starting points of either debating team appeared to be the same moral concern for biodiversity loss. All participants would most likely primarily justify their claims according to what Boltanski and Thévenot refer to as the 'green order of worth'. Indeed, the promises of BDO are cast in broadly progressive terms for 'environmental improvement' and to 'protect and enhance biodiversity'. I queried therefore, whether this was a dispute over the means towards more or less the same 'ends'? Did it mirror the early debates associated with de-coupling the regulatory means from the regulated ends in in 1970s detailed in chapter 4? Or is there more at play? Are the environmental 'ends' themselves in question? Is there an elusive consensus over the target for biodiversity 'gains' in a quantitative sense? If the latter is the case, how can this insight shed light on the social processes that constitute the worth of nature? More specifically, which 'nature' is being disputed? Moreover, how is it that advocates and practitioners experience the search for legitimacy themselves and ground justifications in a

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ending points. Latour (1993 cited by Blok 2013: 6) advocates for a middle ground of 'indeterminacy' whereby nonhuman entities are never treated solely as a means for some human endeavour but always and at the same time treated as an end in themselves. To overcome this impasse (human or non-human oriented moral philosophies), Latour proposes we instead remain attentive to the 'deep uncertainty in the nature of attachments' between things (1998: 232). Rather than committing to either the human or the non-human as starting points for political philosophy, Latour argues we need to simply 'de-centre ourselves' and certainly not move from a wholly anthropocentric philosophy to a bio-centric one (ibid.).

consistent logic - and, furthermore, *is* the logic consistent? In the absence of overt ideological scepticism to market based approaches, other research has argued that conservationists or ecologists are largely motivated by an 'outcome focused enthusiasm' (Sandbrook et al. 2013). The emphasis on 'outcomes' shapes my hypothesis that the dispute emerges and is sustained not only over the appropriate means of meeting generally accepted 'ends' but through different ideas over what those outcomes and ends should be - in other words, to the green onto-epistemologies (Sullivan 2017) that these ends relate.

Clarifying *which* environmental ends are being disputed through tracing the moral worths of biodiversity further illuminates the normative structuring of BDO's assemblages and the tensions at its heart. My proposal is that these conflicts were not only limited to establishing the appropriate hierarchy of such orders of worth like a domination of market over other political values (means), but to the *many* 'green' orders of worth to which offsetting appeals (the ends).

8.3 Event ethnography - methods

I attended both the main NNL Summit and the counter forum, held the day before, as a volunteer organiser. The context of each event was significant for the nature of the discourse. While the BBOP Summit staged an actual debate with a tabled motion, the counter forum simply hosted a panel with speakers who more or less converged on an agreed critical stance. Thus, in this latter event there was no presence of an oppositional 'other'. My empirical investigation into the architectures of argumentation followed two layers. The first layer entailed systematising the appearance of specifically green frames commonly used in argumentation on either side of debate about BDO. I used this initial layer to arrive at a set of analytical codes that formed the basis for the second layer of research. The latter stage entailed performing a structured, coded discourse analysis of the transcript of the NNL Summit debate using these codes.

During the first layer, I assembled a range of green framings that commonly appear within the BDO dispute. I arrived at these framings deductively from the wider literature in particular Apostolopoulou and Adams (2017) and Sullivan and Hannis (2015) and inductively through my own initial discourse analysis from the NNL Summit and the counter forum. This first layer of research produced the codes with which to analyse the detailed structures of argumentation within the NNL Summit's debate. This initial layer of analysis confirmed the broader proposition of this chapter and aligns with Blok's (2013) view that divergent ontological and moral framings of 'biodiversity'

sustain the dispute over BDO in England. Notably many of these green frames appear diametrically opposed (Sullivan and Hannis 2015) and within oppositional patterns that either facilitate or resist the market value framing of non-human natures. For example where one frame positions biodiversity to be ontologically amenable to being linearly, physically re-created or re-storable through restoration science, the counter frame positioned biodiversity as being substantively 'non-linear and dynamic'.

Many of the green frames drawn from Apostolopoulou and Adams (2017) and Sullivan and Hannis (2015) intersected and overlapped. For example, Apostolopoulou and Adams proposed that BDO en-frames biodiversity in reductive and simplified terms e.g.:

> This narrowing is fundamental to offsetting calculations and reproduces the reductionist myth of simplicity' (Levins & Lewontin, 1980 cited by Apostolopoulou and Adams 2017: 2).

The code (green frame) I drew from this statement was *reducible and simple.* A similarly overlapping frame put forward by Apostolopoulou and Adams 2017 conceives of biodiversity as a series of *isolated units* e.g.:

> The creation of offset metrics to represent ecological losses and gains through numerical scores (Environment Bank, 2013) involves a narrowing of focus to isolated parts of an ecosystem (Apostolopoulou and Adams 2017: 2)

The full table of these oppositional frames and examples from the Apostolopoulou and Adams (2017) and Sullivan and Hannis (2015) texts and my ethnographic notes is presented in Table 14.

Table 14 Green frames upon which advocate and critical positions for BDO are based

Green frames of biodiversity supporting BDO (advocates)	Green frames of biodiversity contesting BDO (critics)
Measureable, manageable through ecological scientific techniques	Un-knowable, un-mappable, mysterious
Quantitative	Qualitative, affective, plural in value
Amenable to balancing loss of gain	Non-interchangeable, specific
Restorable, creatable	Non-linear, dynamic
Score of isolated units	Complex, interrelated, entangled ecologies
Reducible and simple	Dialectically composed, dynamic and multi-layered, holistic
Knowable through surrogates	Un-knowable, uncertain and recalcitrant
Manageable through numerical commensurability	Incommensurable with other value dimensions such as numbers
Alienable and individuated	Synergistic, embedded, inter-connected
Spatially non specific- abstract	Spatially produced both physically and socially
Privatisable and a ready source of profits	Commonly held, inalienable and integral to social-environmental justice
An entity for which which markets have the due responsibility to govern – a public good best delivered through a private mechanism	A civic common to be protected through effective land planning and regulation
Service provider – instrumental value	Biocentric – intrinsic value and therefore priceless

I subsequently distilled this full range of overlapping frames and their oppositional counter-parts into a condensed framework of codes and used these to analyse the transcripts from the debate. The condensed framework is shown in Table 15. Following Thévenot et al. (2000), I wanted to test whether these green frames could be shown to be uniquely 'green' or whether they were positioned in a compromise with other original orders of worth, and if so, which one.

In reflecting back on the green compromises set out in Table 13, it was readily apparent that while some of the green frames supporting or disputing BDO emerge as unique 'green' orders of worth many are indeed nested within or feature as compromises with the others. A moral-political understanding of biodiversity as something belonging to the 'commons' rather than private property, for example, is not simply biocentric (as biodiversity as an end for and of itself) but couched within the civic order of worth over

the appropriate means of governing non human natures. Similarly, Table 15 frames a contrast between biodiversity as encapsulating instrumental over intrinsic value. This contrast positions the first as a belonging to political philosophy and the latter as a singularly green, biocentric value system. I subsequently applied the codes of Table 15 to the data with the computer assisted qualitative analysis programme Dedoose, to analyse the range of ontological framings of 'green' invoked through the dispute over biodiversity offsetting.

Table 15 Qualitative analysis codes built from 'green compromises'

Advocates in favour of BDO (opportunity)		Critics against BDO (risk)	
Green value frame	Order of worth compromise	Green value frame	Order of worth compromise
Measurable, quantifiable, amenable to 'cuts' in making units	Industrial	Unknowable – scientific uncertainty complex, un-mappable, non-linear, dynamic, layered, holism and synergy	Industrial
Anthropocentric/ utilitarian service providers	Market, civic	Biocentric - intrinsic end it itself	Green
Bio-physical, socially and culturally neutral	Industrial	Socio-culturally made and entangled	Civic- domestic compromise
Common good to be aligned with private means and ends	Market	Common good to be maintained by common means	Civic (the ends are agreed upon but the means are different)
Substitutable, transferable (achieved through restoration ecology)	Industrial	Specific (non-fungible, de re)	Green

8.4 Results

I devised this discourse analysis as a way to build on the contributions put forward by Sullivan and Hannis (2015) as well as Apostolopoulou and Adams (2017). I sought to systematise which of the green value frames of biodiversity onto-epistemologies appeared as singular greens and which ones appeared as compromises, and how actors used these in practice. The results show that actors tend to mobilise a patchwork of green compromises in favour of or against BDO (shown in Table 16). The results also revealed interesting insights into how the compromises are structured and the ways they are mobilised in the dispute. The coded outcomes from each side of the debate revealed that the three speakers arguing in favour of BDO as an opportunity invoked green justifications and ontologies from Table 15 aboev, 26 times. The critics invoked green justifications as the basis of their argument, 38 times. The results are shown in Table 16.

Table 16 Results of coding exercise on debate; *Agree to disagree*

Green code	Advocates	Critics	Totals
Anthropocentric service provider	1		1
Bio-physical, socially neutral	1		1
Bio-centric	1	2	3
Measurable	6		6
Public good- delivered privately through market	8		8
Public good- protected through commons	2	8	10
Socio-culturally entangled	1	5	6
Spatially specific	1	8	9
Substitutable - transferable	3		3
Unknowable through surrogates	2	15	17
Total	26	38	

Notably, both sides of the debate mobilised a combination of green compromises simultaneously. Neither party in this debate used a vocabulary in purely pro or anti position. However, the code occurrences were weighted differently between the advocates and the critics showing some divergence. Within the first group, the BDO's advocates, the most frequently mentioned green justification as a compromise with the market order of worth (n=8/26 or 31 per cent) positioned the idea of biodiversity as something that is fundamentally a public good *but* can best be delivered through private or economic mechanisms. This idea of separating the means from the ends (assuming that the 'end' is a stable normative goal) returns us to the initial opening premise of the inquiry within this chapter. The following excerpt highlights this code and recounts the dialogue between Tony Juniper as chair and Susie Browline in relation to BDO as a means of environmental governance that is preferable over land planning:

> Is this not a distraction away from designating national parks and nature reserves that should be there as a matter of law rather than economic

> disincentive? Tony Juniper, Debate Chair
> I think that that is a fantastic theoretically excellent point but the main obstacle to that is that countries simply don't have the resources to do that. In South Africa we have an excellent network of protected areas, but we have thousands of other priority sites that will never be protected we simply don't have the resources to do that. So theoretically great, but in practice - doesn't work.' Susie Brownlie

At its heart, this justification is the pragmatic neoliberal compromise where the market is deemed as a naturalised replacement for the shortcomings of the State.

The second most frequently mentioned 'green' the advocates invoked (n= 6/26 or 23 per cent) was an idea of biodiversity as something un-problematically measurable through quantification processes (green-industrial compromise, see Tables 13 and 14). This frame, noted strongly in Apostolopoulou and Adams' 2017 article, sees biodiversity as being 'brought into account' for decision making with the metric. An example excerpt from this code:

> To deliver accountability, first deliver accounting, measure what is lost and what is gained. We have a great opportunity, through the offsetting metric to do this now. Societies must demand that their local authorities demonstrate net gain in their decisions. Tom Tew, CEO of the Environment Bank.

On the other side of the debate, the critics' frames, unsurprisingly contrasted against the green values mobilised by the advocates. The most frequently invoked green as a form of critique (n=11/38 or 29 per cent) was the contention that biodiversity is in many ways 'unknowable', characterised by scientific uncertainty, thereby undermining the industrial truth test of the compromise as iterated in Boltanski and Thévenot's (2006) original schema. The 'unknowability' frame directly contrasts with the 'measureable' one above. In this respect, biodiversity is conceived to be intrinsically incompatible with reductive methods of measurement such as the DEFRA metric. An example of the biodiversity as 'unknowable' frame lifted from Apostolopoulou and Adams 2017:

> No single surrogate (or even a series of them) can entirely capture biodiversity, since not all biodiversity attributes are measurable, and therefore it is impossible to guarantee that no biodiversity is lost (and thus that No Net Loss is actually achieved) (Apostolopoulou and Adams 2017).

An example excerpt from the debate data is as follows:

> There's another thing we should probably be honest about restoring biodiversity and ecosystems. Technically it is very difficult and I think there are few in this room who would challenge that…And therefore I start to get a bit uneasy when we talk about biodiversity in terms of units, which can be, as the DEFRA green paper puts it, bought off the shelf. It makes the assumption that you can swap it and you are losing nothing. Hannah Mowat, Fern International

> If, as a society we decide we don't care about biodiversity, we will lose biodiversity it is as simple as that. So either we will win the social fight, that you need to value biodiversity, not necessarily a monetary value but give it a value or we lose it, and the idea that you can lose the social fight but still win it through some sort of clever metric or some sort of technicality or mechanism is just not the case - it doesn't work! Aerial Brunner, Birdlife International

The two second most frequently invoked green frames used by the critics were equally weighted (n=8/38, n=8/38 or 21 per cent each). The first emerged as the counter-stance to the means - ends frame of biodiversity as a public good. This position saw biodiversity as a public good and as such, something that should *always be* delivered through public regulatory means (market-civic compromise). For example:

> The devil is always in the details, and by the way there are other ways to make the polluter pay. The obvious one, and in the US you are not even allowed to say it in public, it's called taxes! So, if the idea is to make certain types of development less appealing, for example you want to drive people off green fields and onto brown fields, well slap a nice development tax on green field development and you will see that this will change people's calculation. This is not a concrete detailed proposal but the point is that there a lot of ways of making the polluter pays principle work and one of them is through taxation and the other is through proper land planning. Aerial Brunner, Bird Life International.

The other equally weighted code related to biodiversity's *specificity,* as something non-exchangeable through its uniqueness and embeddedness in place:

> But of course, we all know that biodiversity is not an abstract term, people live in biodiversity because biodiversity are places, it is our wider world. And if it's not about biodiversity but about the places in which that biodiversity is, in that

> case places are unique, and biodiversity is unique and therefore can't be replaced. Hannah Mowat, Fern International

The 'green' under the code of *specificity* - conveying non-substitutability and non-fungibility is arguably a bio-centric singular green; it reflects a value in biodiversity that is an end in itself. It is not surprising that critics invoked this moral worth of biodiversity as a way to criticise BDO. It is however, interesting that this was not their primary critique. The primary grounds on which critics contested BDO were through undermining the industrial order of worth of the green-industrial compromise, by emphasising the technical fallibility of ecological currencies and quantification - based on biodiversity's 'un-knowability'. Under this critique, biodiversity's ontological mystery defies epistemological and technical capacities of simple reflection through surrogates. This frame positions biodiversity as *unknowable* and resistant to the pacification of the metric's modernising and rationalising values. As Apostolopoulou and Adams (2017: 2) point out:

> In reframing biodiversity as fully replaceable and re-creatable by human action, offsetting deliberately confuses the state of ecological restoration science and practice with its aspiration.

8.5 Discussion

This chapter has employed a pragmatic sociology of critique matrix to make sense of how the ontologies and moral worths and value framings of nature are mobilised for and against BDO. The results from the data analysis align with Blok's (2013) contribution by highlighting that the controversy over BDO does not relate to simply one, universal green order of worth or one definition of biodiversity. Instead 'many green orders of worth' sustain the dispute over BDO, especially in binary oppositional value frames. Furthermore, it illustrates that although a variety of green values shape the debate, these frequently appear in compromises with other values, which through injecting further moral complexity, deepens the impasse. In summary and discussion I highlight four points that are relevant to my broader investigation into the assembling of value through biodiversity offsetting.

1. *Green compromises of BDO; disputing BDO's rationalising tendencies*

For the most part, the findings show that critics and advocates draw on green justifications with other orders of worth, according to the market, industrial, civic and domestic spheres as illustrated in Table 13. Advocates constructed green-industrial

compromises through a belief in the technical accuracy and ecological capacity of the metric to produce appropriate measurements of value. For this group, accounting for and managing nature through audit technologies was deemed to be a good thing, and thus leant moral weight and further justification to the frame. Somewhat surprisingly, the analysis also shows that the main moral-political strategy used to mount a critique in this debate was to use forge a compromise with the industrial order of worth. Critics used the industrial 'reality test' (Boltanski and Thévenot 1999) to undermine the coherence of BDO by emphasising the fallibility of ecological science and biodiversity's measurability. Critics contested what Turnhout et al. (2014) have called the growing 'measurementality' of biodiversity conservation, premised on techno-managerial ideals of control, standardisation and audit. This critique rightly points to the tendency of BDO's scientific knowledges to ignore over a decade of ecological research into systemic approaches (consisting of ecological dynamics, processes and interactions) and instead fixates on habitats and species as static units (Calvet et al. 2015b). But similarly, the critics' industrial reality test signals the continuation of a longer debate and value struggle in conservation generally. This struggle sees the shaping of the biodiversity conservation's knowledge and institutional framework by ecological science as always having been related to the rationalisation of nature through control and management (Adams 1997b). For this reason, offsetting, according to these critics is an inherently risky and dangerous endeavour since it is driven by the same 'rationalist project that has generated the damage that conservationists wish to oppose' (ibid.: 287).

2. Playing with the 'master's tools'?

It was noticeable how speakers (critics) at the Counter Forum tended to focus less on the fallibilities of measurability or restoration science according to the industrial truth test. Instead, in this context, where there was no antagonistic 'other' critics emphasised the intrinsic green values of biodiversity and its specificity, evoking non-exchangeability and socio-cultural entanglements. This is an important difference, even if it emerges from a somewhat impressionistic observation in the absence of a thorough going coding exercise on the presentations of the Counter Forum. This difference is significant because it shows that interlocutors mobilise argumentative strategies in different contexts for different audiences (as also discussed in chapters 6 and 7). As I have shown, in the debating context of the NNL Summit debate, critics mirrored the advocates by drawing on the truth tests from the industrial orders of worth, but so as to specifically to counter them. Sullivan and Hannis (2015) point towards the erroneous strategy of using the truth tests of those you seek to criticise. In reference to their own analytical

engagement with the BDO controversy, they remind us that there are 'limits to what can be achieved by arguing within the terms of reference set by enthusiasts for market-based approaches to biodiversity conservation' (ibid.: 2015: 11). Instead, a more fruitful approach might be enacted through resisting the commensurating frames of value equivalence within each order of worth entirely. In this sense, following, Boltanski and Thévenot (1999) - critics might deliberately 'mix worlds', even if apparently illogical so as to prevent the subjugation of one by another through compromises[40].

Eschewing the 'masters tools' (Harvey 1996) in critique of BDO would entail returning to values based arguments, rather than technical ones. For example, while the green frame of *specificity* was present in the critics' strategies within the NNL Summit debate it was more noticeably evoked at the Counter Forum. This frame appeals to an ontology and moral worth of biodiversity as *specific* in its essence, unique and mutually entangled with biotic, abiotic and socio-cultural places. As a substantively oppositional frame to the idea of exchange, substitutability and spatial flexibility, green specificity therefore clashes with another central rationale for BDO, that is its movability for making space for development (which I discussed in chapters 5 and 6). Green specificity is not amenable to being streamlined, nor rationalised. The notion of biodiversity as specific and inimitable is a unique 'green' order and end unto itself. It cannot therefore be positioned in a compromise. As John O'Neill has observed (2013), valuing a class of objects for their own specificity as 'de re' - meaning 'of the thing', in contrast to 'de dicto' meaning 'of the word' - is an ethical commitment that cuts straight to the heart of sustainability debates. Valuing things as particulars, as you would a person, eludes fungibility and reflects a bio-centric political-moral sensibility.

3. A return to the means-ends debate and neoliberal rationalities

For the BDO advocates, the virtues of market and other economic instruments are taken to be self-evident as natural correctives to barriers towards achieving pre-defined unproblematic ends. Such barriers might include a lack of funding, lack of effective

[40] The cognitive neuroscientist George Lakoff (2004) points towards the material neurological basis for the ways that oppositional value frames are activated in the mind. In his popular work 'Don't think of an Elephant' Lakoff emphasises that critical strategies should never use the language of the frames the strategies seek to denounce. Using the opposition's vocabulary and value frames in criticism, Lakoff argues, positively and materially activates neurological pathways of the mind that are triggered by those frames, thus inadvertently self-sabotaging one's critique and affirming the opposition's logic.

governance, lack of wider interest or political will to protect biodiversity for biodiversity's sake. These perspectives neatly encapsulate a neoliberal ideology (Castree 2008 and Büscher et al. 2012 for a synthesised discussion) that crowds out alternative motivations or policy solutions and provides its own reality tests. Such perspectives also illustrate how the moral normativity of NNL (as an aggregate quantitative goal) sustains a neoliberal ideology with respect to BDO and market based instruments for conservation more generally. In emphasising the market means over the ends, advocates continued to take for granted the idea of one common desirable biodiversity 'goal'. The end point, as these advocates see it, would be an overall quantitative increase in generalised, but un specific biodiversity indicators, reminiscent of the emergence of aggregate normativity described in chapter 4.

4. The performative and circular frames of BDO

Finally, of the many greens identified, the substantive and normative representations of biodiversity as simply quantifiable 'flat' data, abstracted from biophysical context and amenable to market exchange, are outcomes of wider historical and geographical currents, which I touched upon in chapters 2 and 4. As Fredriksen (2017) and Turnhout (2011) point out, the epistemological ordering practices of biodiversity according to various categories and signifiers (non market values) that in turn lend themselves to market valuations, is part of a much longer story than that which this thesis has covered or is able to. I propose that these a priori representations, in tandem with the range of other actants I have outlined, are performative of biodiversity offsetting as a mechanism and biodiversity units as commodities. These frames make BDO and its associated values appear coherent and logical. But this process is circular, as these frames, in turn are actively confirmed and entrenched by BDO. Offsetting *actively* en-frames biodiversity as a series isolatable processes and relationships, amenable to pricing and representation through universal units (Apostolopoulou and Adams 2015).

Boltanski and Thévenot (1999: 373) propose that 'situations in which important reality tests are performed are usually contrived so as to be as pure as possible'. The objects from other worlds are removed in order to discourage criticism and to make challenging the test difficult (ibid.). The calculative and conceptual technologies of BDO, such as the DEFRA metric or the NNL framework can therefore be viewed as both circular truth tests as well as value compromises. Through producing flattened values that lend themselves to equivalence, the metric serves to smooth moral as well as ontological pluralism of biodiversity into one overall prevailing logic. As a truth test that adjudicates the validity of worth according to a market or industrial order, the metric is performative

in a circular sense. It confirms the worth of biodiversity according to the values it itself provides. In so doing the metric acts as a self-referential confirmation of the duly qualified reality of measurable, mappable biodiversity invoked by the advocates in the debate. The metric provides proof by way of justifying biodiversity value in a format that is compatible with and verifiable by the political and technical construction of the BDO mechanism. The metric is, in this sense, performative - it enacts both quantitative and moral-ethical values of biodiversity and is in turn, enacted through them. Through facilitating quantified and monetised mechanisms for exchanging harm for loss, as a scientific practice and economic instrument, the metric may reveal desired environmental ends as 'improvements'- albeit judged according to its own truth test.

In conclusion, reflecting the contributions from Thévenot et al. (2000), the findings from this chapter demonstrate that the moral-political pluralism in society is echoed in the environmental pluralism of ecological disputes. Market based mechanisms like BDO silence this value plurality as well as material biological differences into numerical and monetary values so as to rationalise and flatten them - to simplify. Meanwhile the broader value system in which BDO is couched (principally industrial and market orders of worth) means that actors must forge uneasy compromises with green values or other orders of worth to make claims and counter claims and participate in the conversation. Sometimes these green values undermine and thus counter-perform (MacKenzie et al. 2007) the logic of BDO by appearing in intractable, irresolvable tension with it. Through analysing the structures of argumentation, this chapter has clarified how and when actors mount justifications and critique of BDO, showing the inherent moral complexity that sustains the dispute. Such complexity is unlikely to go away anytime soon. It points towards and the need for an urgent debate about the wider democratic values to which conservation should respond and be positioned to uphold.

PART 5

CHAPTER 9
CONCLUSION

To open the conclusion to my thesis, I start with the conclusion to the DEFRA pilot in the form of the official evaluation report. I reflect on the apparent overlaps and divergences with my own 'unofficial' evaluation study laid out in the chapters above. I then return to my research questions before summarising the trajectory of the thesis and illustrating, therein, the ways in which I have answered these questions. Following the thesis summary I present my main findings and contributions to those wishing to better understand value making in conservation through biodiversity offsetting. Having pointed to the occlusions that valuing biodiversity through offsetting sustains, I will not take for granted the partialities I have unavoidably created in the course of my own research. Finally, therefore, I will discuss some of the research's limitations while reflecting on fruitful avenues for future enquiry, before offering some concluding thoughts.

9.1 An unofficial evaluation of the DEFRA pilot study

Throughout this thesis I have explored the polarising value systems in which BDO in England was justified, enacted and because of which, ultimately stalled. These polarising values sustained a pernicious and irresolvable tension pertaining to desires for expanded economic growth as well as ecological flourishing. I explored the way these values conflicted in chapter 8 and the management of often contradictory values through the situated application of the DEFRA metric and BDO throughout chapters 5, 6 and 7. However, the overarching value tension inherent in the BDO approach, especially for the UK Government was discussed in chapter 4. In this chapter, I illustrated the significance of the pro-development and aggressively de-regulatory political climate in which BDO was embraced by DEFRA and introduced into England's planning system under the pilot study in 2012. I have argued that BDO was originally conceived and initiated by the UK Government in 2010 under a market-green compromise (Nyberg and White 2013). It was this very unequal compromise that could no longer accommodate 'green' values and which has underpinned DEFRA's retreat from the policy since the pilot study.

This paradox is partly evidenced by the delay in DEFRA releasing the pilot's final evaluation report. The pilot study's evaluation report was written by consultants at Collingwood Environmental Planning and the IEEP and submitted to DEFRA in the spring of 2014, yet it only surfaced for public access in April 2016. What was surprising to me upon reading this report was the realisation that I had more or less undertaken an unofficial evaluation of the DEFRA pilot. I arrived at this conclusion after noting that the *official* evaluation research design reflected the focus of my own research by tracing:

> Individual development projects and associated offsets: including the identification and accreditation of offset providers and engagement with developers; development of legal agreements, formal approval and monitoring arrangements; and use of the metric around specific development projects. (Baker et al. 2013: 1).

Over the course of my research, several of my interlocutors also described their participation in the evaluation, yet more than once noted that I was seeking far more detail than the evaluation interviews had done. Perhaps less surprising therefore, and also moderately reassuring, was that many of the findings put forward by the official evaluation report upheld and reflected many elements of my own findings laid out in the chapters above. In particular, the report emphasised that the development of offsetting under the pilot study was slow coming and peppered with institutional, governance and other practical challenges prohibiting the establishment of the approach. Like my own findings, it noted that where BDO did eventually get underway at particular sites during or since the pilot period, it was largely contingent on the specific arrangement of elements and actors located there. The interim evaluation report in 2013 stated, for example that 'ecological, procedural and spatial planning expertise appears to be necessary for the effective delivery of the offsetting strategy' (Baker et al. 2013: 2). In relation to this prior point, the evaluation also noted throughout, that the unique attributes of the WCS pilot site (chapter 5) enabled it to gather disproportionate experience in using the mechanism, making it a rare example of how biodiversity values are made in practice under the offsetting mechanism.

Other findings from the DEFRA evaluation study that overlapped with my own, which I discussed at different points throughout the case studies in chapters 5, 6 and 7 are presented in Table 17.

Table 17 Overlapping results between DEFRA evaluation and my own unofficial evaluation

Official DEFRA Evaluation Report Key Findings (Baker et al. 2014a: 3-6)	Findings overlapping with my own
Very high quality and quantities of ecological and biological spatial data and expertise were essential to implementing BDO	The size of the LPA team, the presence of a broker and the ecological and spatial data records (the HBA) at the disposal of the WCS pilot in chapter 5 were shown to be necessary components to the building of a market like infrastructure for BDO. Comparatively, in South Devon a smaller team and the poorer data set prohibited the emergence of the policy.
'The metric omitted certain ecological aspects such as species, ecological connectivity and habitat function'.	Illustrated most strongly in the efforts to form a hybrid currency between habitat and species units in chapter 6. The metric's partialities were also evidenced through its design features detailed in chapter 4. I discussed how the metric sought to balance ecological precision with economic efficiency as well as policy pragmatism, thereby resulting in it not 'seeing' anything that its algorithms did not provide abstracted categories for.
A shortage of LPA resources (in all sites except Warwickshire) undermined the ability of LPAs to promote BDO and the metric more widely to planning stakeholders. The paucity of regulatory capacity in general was also associated with difficulties in developing the necessary frameworks and local policies (due to the weaknesses of national policy) that would empower LPAs to impose a mandatory programme of BDO on generally unwilling developers.	In all case studies, the presence of intermediaries to enable translations between and enroll different actors and actants to the network was key to the realisation of offsetting in practice. Motivated and empowered individuals that were able to insert NNL as a policy standard to institutional frameworks in chapters 5 and 7 illustrated the potency of this element for the development of actual offsetting approaches.
A lack of knowledge and experience stalled LPAs' abilities to define the costs of different types of habitat creation and restoration in compensation biodiversity units.	The overall sense of 'muddling through' I discussed in chapters 5 and 6 illustrated the ways in which local government ecologists and officials work with partial knowledge and capacities according to a spirit of 'getting something back for nature'. In the absence of predetermined habitat creation costs bespoke BOMP reports are required. In the case of South Devon, the LPA sought expedient solutions such as the RSPB's original costing methodology for cirl bunting grassland.
Problems in identifying receptor sites for the provision of credit units prohibited an offset market from forming	I discussed the shortage of receptor sites throughout chapters 5 and 6 and discussed the differences between these as LPA sites

	and the hastier process with the TLP offset, as a corporate voluntary process. The absence of receptor sites during and immediately after the pilot period is reflected through the emphasis of the empirical evidence presented throughout, which dwells at the valuation processes related to impacts rather than offsets. The receptor site shortages also directly relate to the efforts to establish habitat banking models in chapter 5.
Evidence that BDO is occasionally undermining the mitigation hierarchy through allowing developers to leapfrog prior steps towards compensation.	Although my empirical evidence did not explicitly identify leapfrogging of the mitigation hierarchy, it was apparent in several cases that BDO can easily confuse matters as planners still cannot easily distinguish between mitigation and compensation under BDO. In chapters 5 and 6 I discussed examples of where the presence of BDO had influenced decision making processes and deflected civil society contestation to the development. Conversely I noted in chapters 6 and 7 that ecologists and NGOs often felt that mitigation provision is actually more problematic than offsite compensation because of the mitigation habitat's proximity to urban development and the lack of effective ongoing monitoring.
Stakeholders perceived that the value of a the metric lay in its quantification of impacts for ease of communication to other audiences	As a means for simplifying the ways in which actors spoke about biodiversity impacts, the potency of numbers as communication strategies was apparent in different ways in each case study. We encountered this most clearly in chapter 7.
The timing at which BDO is introduced was important and required 'early engagement between applicant and authority'.	In chapter 6 I discussed how developers contested compensation provision on account of the stage in the application process in which it was proposed. There is a bigger issue here around the political economy of land markets and its connection to the affordable 'housing crisis' as well as the minimal allowance for biodiversity on account of developers' squeezed profit margins.
Many contracts involved significant negotiation between LPAs and developers over arriving at the BIA scores and the costs of offsetting. Applicants typically searched for cheaper solutions or refused the full costs associated with delivering compensation, since these would result in fees higher than under current practice.	This feature was the basis for the section in 5.3 'Something we can live with' where the establishment of impact values and compensation costs were actively negotiated by the developer and LPA. Searching for 'value for money' and concurrent adjustments to the metric's scores was present in each case study.

The final point of this list is among the most significant in illustrating the paradox in which DEFRA's engagement with BDO was situated, specifically: the wider, overarching political commitment to England's developers and house builders. The finding is particularly relevant, therefore in speaking to the report's evaluation objectives. These were to:

> Assess the extent to which the biodiversity offsetting pilots:
>
> A) Help to use resources more effectively to delivery greater benefits for biodiversity
>
> B) Streamline the processes for agreeing compensation for biodiversity loss as required by planning policy, *in a cost effective way* (Baker et al. 2014a: 15 emphasis added).

In relation to these research objectives, the report's summary showed that actual experience of BDO was almost completely inimical to what Government hoped it would be. The evaluation report anticipated that BDO would require extra capacity and funding for local government and eventually increase rather than decrease the compensation costs for developers therefore countering their manifesto pledge to house builders:

> Evidence from the pilot programme suggests that whilst biodiversity offsetting has the potential to deliver improvements in biodiversity outcomes it will require *additional resources* and ecological expertise in local authorities to deliver it and in instances where residual biodiversity loss is identified will *increase costs for developers* compared with current practice. It is likely that it *would at best only deliver marginal benefits* in terms of streamlining the planning process for agreeing compensation for biodiversity loss' (Baker et al. 2014a: 6, emphasis added)

Thus, as a form of official appraisal, the evaluation report outlined the many 'failures' and barriers to 'success' for BDO during the pilot study according to its own normative standpoints. The invisible hand could not, in other words remain hidden after all in conservation governance. Instead, offsetting required sufficient (and more than Government was willing to give) regulatory input to initiate, catalyse and stabilise a market like infrastructure for biodiversity compensation in English planning. 'No net loss' of biodiversity was, in the end shown to be incompatible with the neoliberal drive

towards the *net loss* in regulation, even if it was originally conceived to be in line with this imperative. Herein lies the central paradox of BDO in England that is indicative of the wider value plurality and complexity that it encapsulates.

The evaluation report catalogued various failures and successes defined against the programme's *own* terms of reference - in seeking to achieve a 'no net loss' of biodiversity while streamlining the means by which biodiversity decisions are disposed of within planning processes and making it cheaper and faster to do so (DEFRA 2013). Through my analytic of assemblage, failures can be interpreted as tensions or counter-performativities (MacKenzie et al. 2007), Li (2014: 600) uses the expression 'lines of fracture', that threaten the assemblage from stabilising towards market formation. In so far as my thesis contributes another form of appraisal of the DEFRA pilot, I propose that a portion of my findings ally with those of the evaluation and have thus engaged in a form of immanent critique (Castree 2008). Immanent critique shows that the object of analysis fails according to its own standards (ibid.), the terms of reference are commensurable. I too have pointed out the shortcomings of BDO according to its own terms of success - to the lines of fracture inherent in the offsetting model, threatening it from stabilising (Latour 2005). I have already discussed the multitude of compromises and value schisms that BDO entails at every step of the process, which actors necessarily navigated as they 'muddled through' to keep things going (Li 2007a). This includes the aforementioned paradox of BDO as a neoliberal market based policy that cannot meet Government's expectations and proves that economic and environment rationales are not the easy bed-fellows the 2011 White Paper would have us believe**.** The rupture is also evident at the level of the actual DEFRA metric, which must continually enact acceptable compromises between policy pragmatism, economic efficiency and ecological precision. Other failures are evident in the way economic imperatives shape the trajectory of offsetting in practice. The arrangement of offset sites in habitat banks according to pragmatism and the minimisation of transaction costs with large private landowners may or may not align with the habitat spatial strategies intrinsic to the Lawton Review's original vision for offsetting. These failures according to the policy's own terms are also manifestly evidenced by the precarity of the actual value calculations that were produced, and their propensity to simply reflect prior configurations of power in the English planning system.

But in divergence, my thesis' focus has also been intensely concerned with another kind of critique - one exploring the axiomatic basis of the move to 'value' biodiversity using offsetting and the normative policy ideal of 'no net loss'. This alternative form of critique

is the gateway to the remainder of this concluding chapter, and is aptly articulated by Foucault:

> A critique is not a matter of saying that things are not right as they are. It is a matter of pointing out on what kinds of assumptions, what kinds of familiar, unchallenged, unconsidered modes of thought the practices that we accept rest. (Foucault 1981 cited by Palsson and Rabinow 2008: 91)

In contrast, the evaluation report remains attached to the calculative and normative standard of NNL while noting that it is 'apparent that the current system needs to be improved in some way if no-net-loss policy is to be met' (Baker et al. 2014a: 6). As I discussed in chapter 2, commitment to the ideal of NNL on either technical or ethical grounds (which I have argued are entirely entangled with each other) is fundamentally grounded in an epistemological and ontological commitment to the balance sheet accounting approach to save biodiversity through calculating and capturing its 'values'. 'No net loss', therefore is neither a neutral or self-evident goal for conservation. Even in cases within my enquiry that make demonstrative claims to having achieved a 'net gain' (actual time to 'target' habitat maturation notwithstanding) offsets still require social consent to the adequacy of such representations (Robertson 2012). This consent, Sullivan (2017: 231) argues, derives from processes of disavowal mounted as a form of psychological 'defence', appearing thus as a 'fetishised substitute for facing and reducing the cause of environmental pathology'.

Questioning the assumption that such values exist in any *a priori* sense, thereby circumscribing their management to accounting and economic practices formed the opening gambit for my enquiry laid out within the preceding chapters. With this in mind I return to my research questions to frame my thesis summary. In this thesis I asked;

1) How is biodiversity offsetting assembled discursively, institutionally and materially as a governance approach?
2) How is habitat turned into a market good?
3) How do actors manage tensions associated with the formation of BDO policy and production of the valued entity, the biodiversity unit?
4) What are the implications for policy and practice?

9.2 Thesis summary and main findings

This thesis has empirically documented efforts to value and trade biodiversity values in English biodiversity offsetting frameworks. Specifically, it has focussed on how actors

make sense of BDO and enact the mechanism in situ as well as the broader institutional arrangements, material devices and discursive frames that made this possible. The thesis has contributed detailed empirical examples of how biodiversity values (as 'units') are made and exchanged *in practice* through offsetting and with what effects. Such examples make a unique contribution to a wider scholarly context of relative case study paucity of BDO. They demonstrate the value of performative and assemblage-based analysis for understanding the practices of value making within the 'green economy' as well as the empirical specificities of BDO.

In chapter 2 I introduced my conceptual foundation, which combined political ecology interests in the power of certain environmental framings (I labelled abstractions) amenable to being translated into universal equivalents in the production of exchange values under commodification. I drew from Robertson's (2012: 388) theoretical diagnosis that the relationship between abstract signifiers and economic exchange can be explained by the ways in which a 'Derridean concern with the ordering of appearances could speak constructively to the Marxian concern with the constitution of abstraction'. I subsequently combined performativity literatures from economic sociology with assemblage literatures from ANT to frame my methodology through which I could empirically trace the associations combining in networks that shape and sustain the circulation of such abstractions.

In chapter 4, I traced the historical background to the conceptual technologies rendering biodiversity conceptually and practically 'offsettable'. In particular I followed the emergence and movement of the increasingly immutable aggregate rule of 'no net loss' of biodiversity, noting its origins in US environmental policy in the 1970s and re-scaling to local and national English contexts 40 years hence. I illustrated the political drivers for conceiving of aggregate technologies in environmental regulation and showed how such technologies were transferred across institutional and geographic contexts. In this chapter I highlighted the role of key brokers and intermediaries that assisted in performing these translations. I outlined the role of individuals within BBOP as policy entrepreneurs seeking to institutionalise NNL amid growing overlaps between business, NGO and state actors under a nascent field of 'business and biodiversity' (Wilshusen and MacDonald 2015). Drawing on the analytical lens of practices of assemblage (Li 2007a), I noted how 'forged alignments' through discursive and normative reasoning came to combine imperatives for economic growth with stabilising imaginaries of biodiversity as a general, abstract and interchangeable state or aggregate quantity (Maier 2012). I also highlighted that these political, scientific and ethical currents coalesced in England in

2010, when BDO was introduced within a broader political moment of de-regulation, financial austerity and a consolidating scientific-policy consensus around the economic values of biodiversity.

Again at this locale, intermediaries served as lively advocates for offsetting in promoting it to mainstream planning policy. I framed a revolving door of individuals, traversing governance scales lending substantial weight towards the potential and importance of undertaking a mandatory system of BDO in England. Finally, having considered the socio-political processes that lead up to DEFRA's announcement of a BDO pilot study in 2011, I introduced and analytically dissected the calculative device that was necessary to fulfil the quantitative, calculative drive of NNL policy within a BDO model. Within this discussion I unpacked some of the metric's background assumptions and inherent tensions to illustrate how it was able to strike pragmatic compromises between ecological precision as well as economic and policy pragmatism. Through connecting the historical origins of NNL to the conception of the DEFRA metric in England, I introduced NNL and the DEFRA metric as two of BDO's foremost actants and illustrated the associations between them.

In the three DEFRA pilot sites that comprised chapters 5, 6 and 7 in the empirical exploration of how BDO worked and values were made in practice, I illustrated *how* habitats are made into market goods (or not as the case may be - when actual market arrangements did not materialise). Following the LPA pilot case studies of Warwickshire and South Devon through chapters 5 and 6, I traced the iterative layers of value making under BDO with calculative technologies (DEFRA metric and the Habitat Biodiversity Audit) through the subsumption of biological heterogeneity to universal equivalents as the basis for comparability and exchange. I demonstrated how values are enacted as numerical surrogates and denoted as a fabricated currency of 'biodiversity units' with the use of the Biodiversity Impact Assessment (BIA). I demonstrated the way in which scientific uncertainties in relation to particular habitat classification in chapter 5 and the establishment of boundaries for a single hectare of cirl bunting habitat in chapter 6 were navigated and stabilised by actors in practice. These layered textual inscriptions, with numerical surrogates later became black boxes and incontestable scientific facts (Callon and Latour 1981). I illuminated how qualitative data inputs from conventional habitat surveys are processed and codified through the Excel algorithms of the DEFRA metric to produce abstract numerical representations of impacts and gains. The cases clarified the commensuration processes of the metric, through its work to 'make things the same' (MacKenzie 2009). In so doing I highlighted the sometimes surprising and ecologically

unintuitive (Sullivan 2010, Carver and Sullivan 2017) outcomes these fabricated equivalences create. In particular, in chapter 5, I demonstrated this by exploring the role of football pitches that through their large *spatial value* (as legitimate numerical inputs to the equation) could provide very high *biodiversity value* mitigation values. This commensuration was made possible through the metric's enactment of a flat, numerical value system that enabled but also concealed the true nature of such trade-offs. I showed the role of spatial area as a valued field within the algorithm that can stand in as a replacement for other valued indicators such as habitat distinctiveness or condition.

In considering the question of how habitat becomes a market good I have emphasised the multiple components (human and non human) involved that come together as socio-technical assemblages to produce biodiversity units as valued entities (Bracking et al. 2014). I have demonstrated throughout this thesis that whether and how biodiversity values are manifest under BDO and if they reach the point of trade, are thoroughly conditional on the configurations of elements that are actively involved. In tracing the socio-technical assemblages of BDO and biodiversity values through my three in depth case studies, I identified the starring role of catalytic individuals and their collaboration with brokers and intermediaries. As Latour (2005 cited by Greenhough 2011: 136) notes 'each assemblage requires labour, materials and agents to fuel assembly'. In chapters 5 and 6, labour was contributed by motivated individuals in the ecology departments at the local planning authority at the county or district council offices. Nevertheless, biodiversity offsetting was, for these professionals, simply a mechanism through which they sought to meet national planning policy set out in the NPPF in relation to achieving a '*no net loss* of biodiversity'. It was not therefore an overtly ideological commitment to economism or market-based governance but a pragmatic response to an accepted policy goal. In these contexts NNL was generally adopted uncritically as an ethical and virtuous policy goal, the moral significance of which lent further weight to its perceived coherence.

The moral significance of BDO was further illustrated in chapter 7. In this chapter I outlined the TLP sustainability manager's personal inspiration and ethical commitment to the 'net gain' policy framework. In this respect, for the leading protagonists in all three case studies, NNL and biodiversity net gain had come to embody powerful normative conservation objectives, which simultaneously legitimated and underpinned their efforts to drive BDO forward. In so far as NNL, as a conceptual framework and policy standard, encompasses a moral weight (Stott and Sullivan 2000, Fairhead et al. 2012) and mechanism for quantification under accounting frameworks, it acts as a

boundary object (Star and Griesmer 1993) that can do different things for different actors according to whichever value system they require in the moment. NNL thusly appears as the ultimate market-green compromise (Nyberg and White 2013). The agency of NNL is especially significant as I showed in chapter 8, that in unison with its calculative device, the DEFRA metric, it actively locks in certain framings of biodiversity according to is own reality tests (Boltanski and Thévenot 1999). The calculative and moral entanglements of NNL mean that actors inadvertently entrench neoliberal economistic framings as 'economists in the wild' (Callon and Rabeharisoa 2003), while ostensible making moral claims.

Strategies of legitimation and justification were central to the assembling and stabilising of BDO. Chapters 7 and 8 illustrated how actors tend to mobilise different augmentative strategies for different contexts and audiences. Communications might target senior decision makers or wider epistemic communities in sustainability professions so as to convince them of BDO's value and justify its business case. Sometimes these strategies might emphasise the conservation value of NNL and at other times, its business case. And yet, the market-green compromise is not a settlement without consequences, nor is it a balanced compromise. As I have shown throughout all case studies, green values tended to hold fast until they conflicted with market ones. When they did eventually clash, rather than 'transcending the trade offs', BDO instead opened up a range of new tensions. Conservation practices under BDO were pulled in particular directions so as to comply with market efficiency, economies of scale and value for money.

The role of intermediaries as 'translators' were central to furnishing the assemblage with supplementary expertise, networks and support, in particular, shown through chapters 5 and 7. In chapter 5, I illustrated that due to the pragmatic barriers to market creation through identification of receptor sites, the Environment Bank working within the Warwickshire pilot area sub-contracted another broker so as to assume a vital connection in the biodiversity credit value chain in opening up links to and making contact with large landowners (Figure 12.). For all of these intermediaries and brokers, there was an expectation that an on-going pipeline of contracts would materialise from the arrangements, thus indicating that the interests and importance of consultants and brokers to the growth of the green economy cannot be underestimated. In chapter 7, an almost serendipitous encounter between two professionals became a productive working relationship as TLP defined a new policy standard for net positive impact that was subsequently rolled out to the whole of Network Rail.

In reflecting on serendipity and coincidence, and the frequently ad hoc nature of the arrangements, all three case studies illustrated the development of socio-technical assemblages as a form of 'muddling through', as people and organisations became embroiled in the process. In this respect, I noted how conservation NGOs were becoming increasingly entangled in BDO arrangements simply because it was hard not to. A consistent pattern that emerged from exploring the experiences and views of the RSPB and the Wildlife Trusts was that it was better, on balance to be involved with the pilot study than not to be, so as to ensure that standards remained high or so their organisation could 'be at the table' as the conservation policy landscape changed. The extent to which these organisations' roles are thus shifting in a changing planning-conservation policy landscape and the opportunities and risks such transformations might engender are important questions for future research. I pointed to several implications throughout the empirical chapters and highlighted, that while in some instances more entrepreneurial individuals in NGOs might perceive BDO to be a good funding opportunity, in two of the three cases, BDO also thrust NGOs into sometimes difficult and expensive contractual relationships with developers.

In all three case studies, I demonstrated how BDO processes, despite being perceived to be neutral calculative frameworks, instead create values that people struggle over. Sometimes this lead to negotiations over the ways in which parcels of habitat, or their sizes were classified on the BIA spread sheets. In other cases, adjustments came about at the explicit behest of the developer who considered the compensation requirements to be too high. In the corporate voluntary context in chapter 7, value struggles over the scores were less noticeable since the developer determined the processes, themselves. Adjusting scores to better suit commercial priorities was hardly ever the envisaged ideal of BDO in planning. However, the ability to *not* adjust numbers because you are accountable to no one and control the process privately, as corporate or voluntary programmes will do, is also indicative for some of the concealed but problematic outcomes of corporate biodiversity offsetting. Furthermore, these practices also entailed the conscious selection of offset sites for the provision of units, and the habitat works from which they were to be generated that represented 'good value for money' triggering a series of social and environmental consequences downstream.

In all of the cases explored, the values that the BIA framed depended on overflows and exclusions elsewhere, on things that stood outside of the economic frame (Callon 2007). Overflows were created either because of a substantive tension within the metric itself. For example, its requirements for ease of use, simplicity and pragmatism meant it only

accommodated a narrow subset of ecological attributes. Simultaneously, cultural or social values are invisible to the value calculations and were occluded. This is particularly the case for values connected to specific parcels of land subject to either residential development or the woodland planting works as part of the offset. In chapter 6, I described how the challenges local communities levelled to the planning committee in objecting to the loss of the beauty and landscape features of the urban fringe were necessarily translated into scientific and rational critiques in terms of 'biodiversity loss'. In so doing, these challenges, couched in general abstract terms of 'biodiversity' became easier for the Head of Planning to dispense with *because* they appeared to be accounted for within the calculative frames of the metric. Beauty and cultural or aesthetic attachments to specific landscapes are incommensurate with what the metric can see (or indeed seeks to do) and were thus overlooked as legitimate grounds for complaint. I further explored this issue of value commensurability in disputes through the lens of Boltanski and Thévenot (2006) orders of value in chapter 8.

Similarly in chapter 7, the complexity and messiness of the actual delivery of the offset planting scheme generated social contestation from the local residents. Yet these processes and frictions were actively framed out from the public performances and official accounts of the project's success. The official accounts of 'success' generated social and professional capital (Büscher 2014) for those involved in the project at Network Rail in connection with pioneering a corporate 'net positive impact' policy. Where overflows (Callon 2005, Lohmann 2009) threatened the project of accounting for biodiversity values through enacting offsets, these 'counter-performativities' (MacKenzie et al. 2007) were actively framed out so as to maintain the coherence and the legitimacy of the approach. Numbers were central to the performance of legitimacy and sometimes explicitly deployed to support claims of success. It is in this way that BDO is a circular and performative process caught in a loop of one logic over another. It is this process of performativity that I wish to emphasise in conclusion to this thesis. I illustrated this most strongly in chapter 7, but also demonstrated the political agency of numbers within the planning committee meeting in chapter 6.

Finally, existing assemblages shaped the ways in which the BDO was enacted in specific places. Biodiversity offsetting collided and often clashed with existing assemblages creating hybrids and local interpretations. These existing assemblages included biological data assemblages, in the Habitat Biodiversity Audit (chapter 5), alternative conservation frameworks and value hierarchies (chapter 6) or the political economy of land and housing markets (chapters 5 and 6). The approach was struggling and

stuttering through some spaces and networks, accelerating elsewhere. It was morphing and adapting to the existing frameworks in place and being selectively drawn upon to suit some interests over others. Government had little active role in shaping the way BDO was interpreted, a large part of which was due to its reluctance to provide meaningful regulation. Throughout this thesis I have shown how BDO is a socio-material assemblage that is made up of numerous elements that reconfigure how BDO operates in practice, making it a socially and geographically contingent process and its calculated values and market formations provisional and performed entities.

9.3 Research reflections and future directions

The thesis has provided a robust picture of the many ways in which NNL and BDO as conceptual and valuation technologies are pulling and shaping conservation in new directions. And yet, the picture it presents is also inevitably a partial one that cannot possibly fully account for the contemporary moment or dynamic unfolding of this vibrant policy field. New offsetting events, webinars, reports and programmes are announced frequently, even since the end of the pilot period. Indeed this unruliness reflects a pervasive difficulty with ANT methodologies, 'where the elements that are encountered can rapidly proliferate out of control' (Michael 2016: 50). In this respect, this thesis is inevitably one that was constrained by matters of practicality, and in so doing, created many occlusions of its own.

While I focused on the networked relations between many human and non-human elements within the BDO assemblages, my focus arguably disproportionately tracked the agency of calculative-technological devices in favour of biotic non-humans agents. Although requiring alternative methodologies, a commitment to emphasising the political agencies of biotic non-humans and their assemblages would align with the broader post-humanist turn in environmental geography and political ecology more generally (Whatmore 2002, Bakker and Bridge 2006). Valuable work at the intersection of post-human and resource geographies traces the materiality of unruly biotic entities and assemblages and their resistances towards being translated into inventory (Kama (2015). As yet, this approach has found less footing among the economisation of immaterial commodities such as ecosystem service credits, such that an intriguing future research direction might look towards tracing the 'recalcitrant natures' being subject to various forms of economisation and financialisation under the 'green economy'.

Similarly, I might have also attended more closely to the experiences, roles and values of the individuals and proximate residential communities directly affected by the planning

applications in question. This is especially so given that civil society's values and attachments to landscape have historically and continue to constitute a 'potent source of energy in the conservation movement' in England (Adams 1997b: 287). As the lexicon of 'valuing nature' is picked up and foregrounded in mainstream discourse, it would seem a judicious time for society in general to harness this powerful legacy of civil society conservation efforts and engage in a more deliberative debate seeking to excavate and illuminate the value plurality that the new orthodoxy tends to silence. How can society, and not in ways that depend on commensurable yardsticks of value, embark on a considered and democratic deliberation about not only plural values of non-human natures and the landscapes they encompass as well as the role and meaning of value generally? Further research in this area is certainly warranted.

Such an endeavour seems exceptionally timely given England's political moment, wherein a much broader debate over the future use, funding and 'valuation' of land is underway in the wake of the Brexit referendum vote and decision for the UK to leave the EU (Helm 2017, Mace 2017). In chapter 6, I wrote about the significance of the BDO pilot and the wider natural capital discourse in which it was embedded, for coming to inform the Government's thinking over how to replace the EU farm subsidy system from 2020 onwards. Additionally, I also highlighted the significance of the political economy of land for biodiversity considerations under planning. The performative analysis into BDO using an analytic of assemblage makes one contribution to this emerging research field. Important further research would extrapolate the findings from this investigation into the assemblages of broader land economy in England to better explain how the intersection of these different markets and value systems shapes possibilities for conservation activities in England, in both planning as well as farming discourses.

Throughout this thesis, I have juxtaposed the abstract idealism of biodiversity as numbers against its material embeddedness in land. I have argued that the contestation over different uses for physical space in England is an underlying driving force for BDO, much as the Lawton Review (2010) had originally diagnosed. The significance of this idea is most strongly felt when considering the overt de-regulatory drive of the present Government to 'un-block' the planning system, often increasingly justified by advocates of all political stripes in the name of the 'affordable housing crisis'. The underlying drivers of the paucity of appropriate and affordable homes in the UK are becoming increasingly apparent (Ryan Collins et al. 2017). There is therefore mileage in connecting these insights better to those offered by this thesis, in other words, to insert a critical analysis of land economy, its uses, possibilities and deficiencies into biodiversity

conservation discourses. This effort would appear to be a worthwhile avenue for future empirical investigation building from the findings put this thesis puts forward.

9.4 Concluding thoughts

This thesis has empirically documented the social, institutional and technical processes assembling the values of biodiversity under offsetting in England. I have shown how these socio-technical assemblages are constituted by a range of actants; the human actors in different institutional arrangements, the ontological and moral commitment to the aggregate framing mechanism of NNL, calculative devices such as the DEFRA metric, the political economy of English development policy and other extant scientific, policy and market assemblages to which BDO inevitably binds. Collectively these components constitute the metrological network (Latour 1987) of BDO as an idea and policy approach as well as its valued entity - the biodiversity unit. Through highlighting the connections between all of these things and their specific configurations across scales and contexts, I have shown empirically how values are made under offsetting in England as the effects of these relational actants *in situ*.

Therefore, a central finding of this research, is that the practices of value making in conservation must be understood as a performative project through which values of nature are actively constructed. The socio-technical assemblages of BDO are performative in the sense that they circumscribe activities to enact the value to which they refer (Callon 2007, Çalışkan and Callon 2009, 2010). I wish to emphasise that biodiversity values do not therefore exist waiting to be captured, as Government's rhetoric around the 'true value of nature' (DEFRA 2011b: 66) suggests. Instead the economic values of nature are actively performed through the socio-cultural, institutional and technological practices and processes I have traced throughout this thesis. Moral framings are central to the process - to which DEFRA's above petition also attests. Practices that perform value in non-economic terms, emphasising intrinsic or moral care are thought to actively de-stabilise the economic frames through their counter-performative tendencies. Although, I have shown that frequently these moral value framings are actively co-opted and utilised to *advance* the substantive structuring frames of NNL and BDO, en-framing biodiversity as amenable to pricing and rational management and as non-specific and exchangeable (Apostolopoulou and Adams 2017). Neoliberal conservation techniques are often enabled by a moral imperative (Fairhead et al. 2012) - the road to 'securing the value of nature' using offsetting, therefore is ostensibly paved with good intentions. I have also shown throughout this thesis the ample scope for BDO to succumb to the 'tragedy of the well intentioned valuation'

(Gómez-Baggethun and Ruiz-Perez 2011), as it submits to prior configurations of power, creates a series of unforeseen and often perverse outcomes and signals new, questionable directions for conservation policy in England.

The values of biodiversity under offsetting are stabilised through the on-going interaction of the elements of the assemblage. If any number of associations between these elements fails then the assemblage would stumble and fail. For example, without the DEFRA metric, the value of biodiversity would be little more than a normative ideal conjured through NNL and there would be no means of actually *calculating* 'net' changes to biodiversity. Without NNL and the abstract idea of an aggregate sum of biodiversity made of interchangeable parts, the notion of 'biodiversity units' would be incoherent. Without the array of human actors consenting to the meaningfulness of NNL (in both a scientific and moral sense) the offsetting assemblage would not hang together and the architecture for biodiversity value making would not materialise. Offsetting is therefore performative in a circular way - certain elements support and perform others within the assemblage.

This circularity indicates that the assemblage itself has agency (Deleuze and Guattari 1987) - it expands our 'capacity to envision' (Li 2014) biodiversity as a valued and calculable entity. Therefore, despite DEFRA's retreat from imposing an obligatory programme of offsetting, these assemblages account for the momentum BDO has continued to gather since the end of the pilot study and the continuing logic and coherence of the approach. The world making (Tsing 2000) effects of BDO's assemblages and the new relationships, vocabularies, technologies and alliances it has opened up also act as the means through which the offsetting network is reproduced and extended (Murdoch 1997, Wilshusen and MacDonald 2015). Sometimes these performative processes are explicit. They are conjured as agenda building exercises, otherwise known as 'mainstreaming' in policy lexicon. Such approaches are often lubricated by shared normative assumptions amongst epistemic communities or for those for whom such developments would apparently open up professional or commercial opportunities. For this reason, BDO as a governance approach, its calculative devices and the broader imaginaries of NNL are constituted through mutually circular strategies of legitimation across scales and geographies. Practices of 'forging alignments' and 'rendering technical' (Li 2007a), 'selling success' (Büscher 2014) and the political agency of numerical representations as potent iconic devices (Porter 1995) all play their respective parts in the continuing performativity of biodiversity offsetting arrangements.

I have shown throughout this thesis that BDO and its higher structuring values are together acting to engender actual shifts in conservation thought and practice through enacting and en-framing more than human natures as a series of calculable things and in turn, conservation actors as calculating beings (Muniesa 2011). In this respect both people and devices are endowed with calculative agencies (Callon and Muniesa 2005). These factors bear acute relevance for a changing institutional order of conservation and for the material landscapes it in turn, shapes. My thesis has therefore been engaged with explicating the implications of a valuation approach in conservation noting the necessary occlusions this sustains and the important changes to biodiversity conservation policy and practice it signals.

The thesis has demonstrated that the policy standard and scientific imaginary of NNL has colonised the field of biodiversity conservation in England and in so doing has further rendered non-human life conceptually interchangeable. I say further, because while BDO in England is engendering significant changes in conservation policy and practice, in many ways it simply reflects the continuation of a longer trajectory entailing managerial and scientific rationalisation of nature (Adams 1997b) and neoliberal discourses of environmental planning gains (Whatmore and Boucher 1993). 'No net loss' is characteristic of an *a priori* drive to rationalise, manage and emplace nature according to a singular value framework and preponderant neoliberal economic and development priorities. I have shown how the logic of rationalisation is achieved through the commensurating properties of the DEFRA metric. This logic ensures that it is easier to dispose of one area of grassland so as to permit urban development if it is assumed that some other kind of habitat planted somewhere else and in the future is both intrinsically and scientifically equivalent. Indeed, ideas linking commensuration to rationality (rationalisation) stretch back to Plato, who considered it necessary to render ethical values commensurate so as to prioritise them (Naussbaum 1984 cited by Espeland and Stevens 1998). Numbering, measuring and commensuration are integral to a sense of control - of making sense of complexity (Bowker 2008). But as Blomley (2008) reminds us, 'simplification is complicated', both technically, because it entails sometimes uncomfortable decisions over what to include or exclude and therefore also politically, since this adjudication is never neutral. The construction of BDO and biodiversity units therefore depends on various occlusions - environmental histories, biotic relationality, blurred ecological boundaries, non-scalability and unknowability. All of this could be summarised by what Kathryn Yusoff (2013) refers to as biodiversity's 'insensibility'. These ontological and epistemological factors are additional to the multiple ways these specific

emplaced non human natures are endowed with moral meaning and valued by people with attachments to landscape. In short, BDO cannot accommodate non-rational values and in so doing excludes them. These are not only moral and ethical values but also include alternative ontological understandings of the nature of nature.

If the values of biodiversity are performed through the assemblages they are made up from, then I propose this finding illuminates windows of possibility for alternative ways to conceive of nature's value(s). I therefore suggest that foregrounding the constituent elements of the assemblage, as well as the various tensions and counter-performativities as this thesis has done, invites and arguably demands a broader dialogue over the directionality of conservation and its valuation approach to which it is apparently acquiescing. Since decisions over what to count and how are always a social practice (Muniesa 2007) an acknowledgement of such armed with empirical specificities such as those offered in this thesis, provides openings for meaningful critical interventions.

My thesis has provided an empirically detailed example of value making in the green economy thereby contributing urgent particularity and nuance to understandings for how the values of biodiversity are made in practice (Castree 2002, Lohmann 2012,) and with what effects. Arguably the work of observing how valuation is done is more critical than ever as technocratic forms of environmental management through markets proliferate (Bigger and Robertson 2017). This much can also be said for other areas of public policy becoming rapidly subsumed by their own socio-technical assemblages of valuation. My project therefore is a central contribution to the broader understandings of the changing nature of value in society when a drive to represent more and more things with money and numbers seems to be soaring. For this reason, the findings from my study into the economisation of conservation bear acute relevance for other public policy fields being stalked by valuation approaches (Carver and Sullivan forthcoming). These fields, along with the one forming the basis of this enquiry - assume that the things such approaches ostensibly 'value' are purely technical and scientific when in fact they are also deeply political and ethical.

Even if the 'valuing nature' discourse - experienced by some as an optimistic and transformative opportunity is avowedly in service to this greater effort, the question remains as to whether such practices ultimately serve to render habitats, species, carbon emissions, land titles, water or even human lives even more disposable than before such 'valuation'. This thesis suggests that, where this much is true, a performative reading of valuation yields both conceptual and empirical clarity as well as strategic possibilities for

intervention. On the basis of my preceding discussion, I suggest both appear as immediate priorities for further investigation.

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